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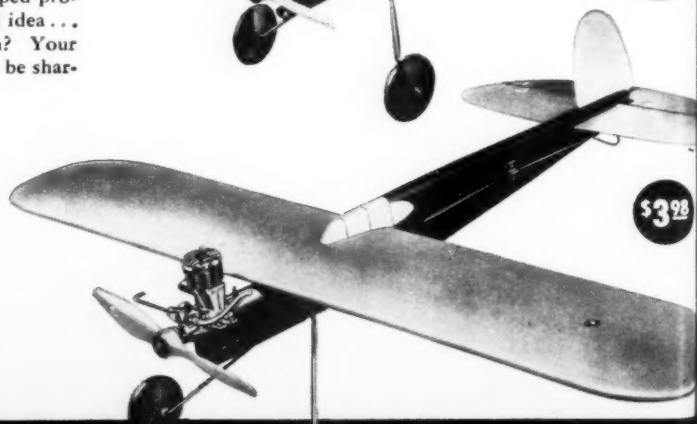
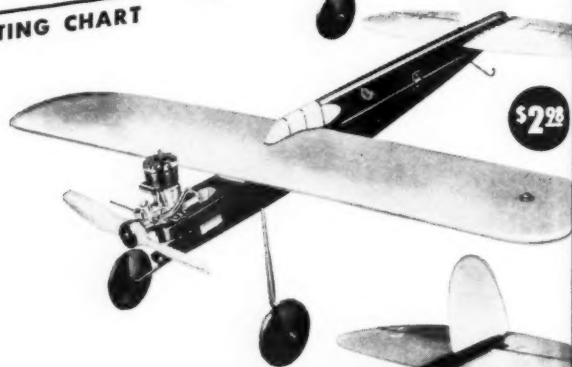
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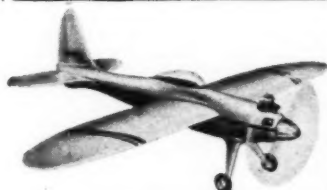
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JANUARY, 1951

VOL. XLIV—NO. 1

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STUNT has taken the house by storm. Things on wires have pushed the free flights, yes, even the R.C. jobs, into the corner. It seems that we had a fifth columnist in our midst, one of these mad yo-yo guys, and we started it all ourselves. It began innocently enough.

Lou Andrews and Don Ferguson (the Senior who did so well at the Nats) who both snagged firsts in stunt with *Traxter Barnstormers*, came by one Sunday afternoon. Lew put through their paces his winning *Barnstormer*, and a pint-sized *Barnstormer*, powered with a *Wasp*. This left a lot of people bug-eyed. On the spur of the moment we asked free flighting Junior how he'd like to have a fling. The next thing you know the dealer fixed him up with a profile job for his *Mohawk 29* and, a week later, got out in the circle with Junior. On the third flight the beginner took off, flew, and landed, something this "expert" hasn't done very well. Now, let's leave Junior and the profile for the moment...

After long talks with the champion stunt lads, the old man cooked up a ship for the *Torp*, about 1-1/2" bigger than a *Warrior*, but with a 2" thick wing section. Wider flaps with less movement were tried since, locally, such linkages had proved attractive. The finished job was turned over to the dealer and various stunt boys, and it was agreed that it was a nice-flying machine. Later, after serving as helper for Junior on several flights with the profile, we gave him the new stunter to try. (Some kind-hearted modeler had let him feel out a *Chief*, just enough to know what a lively machine was like). Like a dope, the helper filled the tank and tuned in the *Torp* until it howled. Junior gave the nod and off it went...

It developed afterwards that a kink in the shaggy lines—we are learning fast!—retarded up at take-off. On this, his eighth flight, Junior gave it full up and it took hold suddenly. The stunter went straight up, all the way, flipped over and bore down on the crew who spread-eagled in all directions to save their heads. When next seen the ship was inverted with the pilot trying to figure out the next step. Came a half outside loop. Came more loops. Consecutive ones, inside and out. Then an overhead eight. All kinds of things we never hope to see again. Brushing the ground. Overhead with the lines sagging. With everyone behind cars and backstops, the engine finally began to sputter—then wham! The lines had wound all the way from the handle to the ship.

"Why didn't you fly it level," we asked the indifferent hot-shot when the fireworks were over. "I couldn't," sez he, and he had done everything but square loops and a vertical eight, not knowing what was cooking, of course. "When you had it upside down why didn't you leave it there," we asked, thinking of the busted ship and the dirtied *Torp*. "It looked funny with the wheels on top," was the answer. When last seen, Junior and two little guys were trying to hand launch the profile in a hayfield. Sure wish someone could tell us how a Junior—never told about inverted flight—knew enough to reverse the controls for some maneuvers. The whole performance was impossible. We are going out back and practice—when the family critics are in school!

Would like to pass on some dope about those thick wings. They pay off. Bob Daily flew thick wing stunters, hence the inspiration. Increasing the lift without adding area, or getting the same lift from a smaller machine with higher wing loading, seemed worth investigating. One thing we had wrong, apparently, was the notion that the thicker wing had more drag, slowing down the ship. Joe Wagner of *Veco* reminds us that the maximum L/D of an airfoil shape like this comes at a fineness ratio of 4 to 1. Actually, 29% gives best results on a model. In other words, 25% thickness could have been used instead of 20%.

Joe has been giving us a bad time over Bob Palmer's phantom crack-up at the Nationals. Seems it was Bob's partner, Dick Piety, who pranged. Bob hasn't busted one in years, in any form, shape, or manner, except for an experimental tank deal a long time ago. Somebody else informs us (re Pappy DeBolt having no trouble) that we should have stuck around. Harold finally bounced one, too. Didn't see it, Charlie. At the 1951 Nats the *Scrap Box* will assign a couple of vice-presidents in charge of prangs. Everybody and his uncle is getting into the act on this business of power for stunt. Wagner, Number One heckler, sez he is a beginner at stunt and had no trouble in a 30-mile wind on a .19 in a *Chief*. Maybe Junior will tell us the secret one of these days.

Would you like to know how a manufacturer develops and flight tests a stunter? (Incidentally, Lou Andrews says his pet test is a saw-tooth flight, just straight up and down, whoom, whoom. Try it!) At *Veco*, Bob Palmer is official U-control test pilot. As soon as a new and different model is complete, it is turned over to him. Having sat in on the design conferences that produced the ship in question, he knows about what to expect. Putting the plane through its paces, he watches such all-important details as general stability in level flight and maneuvers, control sensitivity, tendency to "mush," or stall at various altitudes, and the degree of maneuverability. At the same time observers outside the circle watch for tendency to yaw or crab, evidences of lateral instability such as wing rocking, and smoothness of flight. Several flights are made in rapid succession before any attempt is made to evaluate the performance.

If the designers have done a good job, there are but a few minor changes to eliminate bad characteristics. If any instability shows up, the job goes back for major revision, which results in a new airplane and repetition of the tests. Once by these preliminary tests, Bob then really wrings out the machine. After several such flights they all put their heads together to discuss ways and means of further improving performance. Much of the time, compromises must be made between ideal performance, prefabrication, and ultimate cost to the consumer. When that is done, another model is built and subjected to the same flight test procedure. This goes on until everyone is satisfied with the performance.

Lou Andrews has been fooling with 1/2A free flight jobs of much more than 200 sq. in.; this led to a discussion of airfoils, the NACA 4612 in particular. He had tried this on gas and found it wanting. Opinion was

(Turn to page 34)

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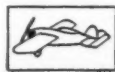
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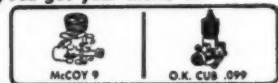
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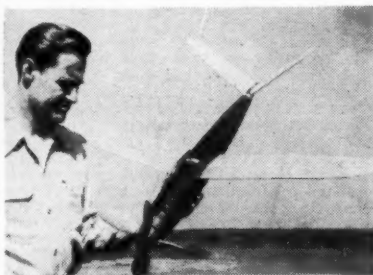
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REPORT FROM THE WEST

by Jim Saftig

WE ARE happy to say that the radio "bug" has definitely taken a good hold "out West." More and more of the free-flight and U-control enthusiasts are swinging to the "tube and transmitter" type of flying. With such men as Doc. Poco, Bill Butler, E. J. Brown, and many more constantly helping the newer fliers over the rough spots, radio control is growing by leaps and bounds. We have even heard some of the rubber men discussing the possibilities of installing receivers in their ships. The overall picture looks very good for the radio events. Recently, E. J. Brown presented a very interesting talk to one of the U-control clubs; radio jobs were brought in and thoroughly discussed. Different types of equipment, both in knock-down and built-up condition, were shown and elaborated upon. Questions were asked and answered with much enthusiasm and the whole program was excellent. Brown brought his original 500 sq. in. ship out, and design possibilities were discussed. We noted that E. J. favored the short moment arm with more fin area for directional stability. His newest ship had a slab sided box section with a back keel, covered with silk as were the wing and stabilizer. The "team racer" type of gear was used instead



Red Everitt's Wakefield with counter-rotating prop

of the wire type. Another interesting feature of this plane was the V type tail that was first built for it. This had the split elevator control using the single channel radio. The firewall had an internal backing plate allowing use of the Arden .999 for conventional flying or the Arden .999 for stunt purposes. E. J. uses the 6J6 transmitter powered-off the car battery with vibrator power pack. The receiving equipment is a modified Control Research outfit. The spiral wound induction coil lessens the weight problem and allows a more compact unit. The chances of this unit being bumped out of tuning on rough landings are greatly lessened due to its compactness. The stab section has a lifting foil to overcome stall in climb tendencies. We have had occasion to witness many flights of this ship and it is definitely very maneuverable.

Brown is doing much to further radio control flying by constantly helping the newer fliers with their equipment. He carefully supervises the transmitter operation of the men not holding licenses at the present time. This supervision should exist at any field where unlicensed fliers might be trying their hand at this type of flying.

We were a bit puzzled when we arrived at the Miramar Emergency Landing Field (not now in use) and saw one of E. J.'s newest ships circling at about 200'. It seems that there wasn't quite enough right rudder to turn the ship in that direction, and it so happened that the ship was in a very hot thermal. All that Brown could do was make large and small circles to the left. Believe us, beads of perspiration were quickly forming on his fevered brow. By very skillful maneuvering and a bit of luck, he finally brought the ship out of the thermal to a beautiful landing just on the edge of the runway. Looks like the man has earned his W6JRG license.

Harvey Patten, another of the free-flight men, has finally succumbed to the radio

way. Harv has built one of the most beautiful originals that we have seen in the air. This ship has approximately the same force arrangement as the famed *Rudder Bug* and carries 550 sq. in. of wing area. The lifting tail is much in evidence also. The model is very fast and of clean sharp design. It sports the conventional two wheeled gear and is Arden .999 powered. The Control Research unit is used and no trouble of any type has been had with it. This ship flew right off the board with Patten, a rank beginner, at the controls. Over 25 flights have been made without a scratch. It looks as though these radio control jobs aren't so tough after all. (It says here in fine print!)

Mom and Pop Robbers forwarded more information about the *Western Associated Modelers* group. It seems that these clubs are in there "pitching" all of the time and come up with interesting and eventful sessions. We sincerely enjoy the competitive spirit that prevails among the northern clubs. Challenge meets between any two or more clubs are frequent, and at the present time a tentative challenge is in the offing between the *Pittsburg Cloud Busters* and the *Stockton Gas Model Association*. This is another round in the "Robbers Challenge" trophy competition. This particular event is to be a team streamer combat. Each club will be allowed one two-man team with the total remaining length of each team's streamers to decide the winners. If necessary, heats will be run to determine who flies in the finals against the two clubs. If this challenge comes into being, and it undoubtedly will, the round will be flown at the coming *Palo Alto U-Liners Contest*. The models will be flown counterclockwise and will carry only A or B powerplants. The lines must measure exactly 60' from the center of the model to the center of the handle. The two men comprising each team must be members of the club that their team represents. On January 13, 1951, at Martinez, California, the *Martinez Aero Modelers* will be the host club for the Association's annual dinner meeting. Mr. J. E. Underwood, President of the M.A.M., is the general chairman for this dinner and has made all the arrangements for a fine banquet. At this meeting the annual election of officers will be held. The annual report on activities, club points, individual championships, etc., will be made and copies of the report will be distributed. The *Champion Club Trophies* will also be awarded. Sounds like a real get-together is in the offing up north.

In September at the *Stockton Gas Model Association Control Line Meet*, at the Oak Park Ball grounds, two new W.A.M. records were established in the speed events. Mark Brown turned 149.88 mph with his original class D job, and Herm Shiman fired up his 1/2A Proto job and clocked in a record at

(Turn to page 36)



Don Moorehouse holds his amazing Super Buccaneer

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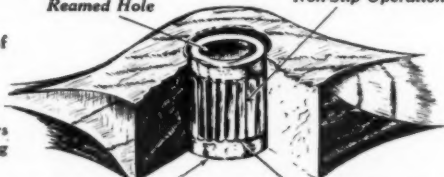
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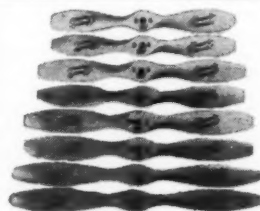
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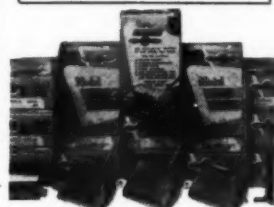
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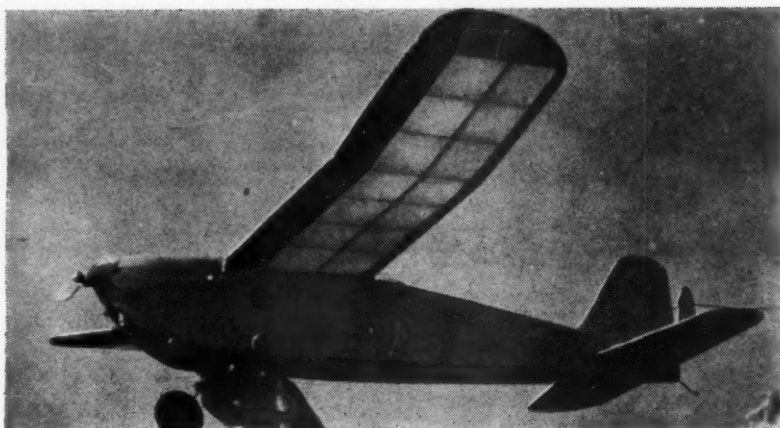
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READY SOON!!!!

Formula 11 and Formula 22
Cements will Soon Be Ready
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Same fine quality as usual.



Roy Mayes with the author's "Little Ship"



The 42 is of very simple construction; has been flown with Mills Diesel (shown) and Cub .074

R. C. Models are getting smaller—here are some ideas on what's practical

RADIO CONTROL PLANES

by **DICK SCHUMACHER**



Two midgets! Rebuilt 33 and the author's young hopeful

THIS could start out with "once upon a time a .19-powered ship was the ultimate in small radio control," but today it is no fairy tale that any ship over .09 cu. in. displacement and 4' span is intermediate class radio control, and .19 cu. in. displacement almost borders the giants. This is normal growth made possible primarily by glow-plug and small foreign diesel engines plus the light RK61 tube receivers, and made practical with battery "charging" (see *M. A. N.*, March '49, page 32) and the current savers described in Herb Owbridge's article in the September, 1950, issue of *M. A. N.*

Radio control in the midget class has many real advantages besides the undeniable appeal of any small ship. Perhaps, most important is the amazing increase in the strength-weight ratio as the size of the ship decreases, a major talking point with the beginner in R. C. who is faced with the inevitable piloting and operational mistakes. Second, and also of major importance, is the inherent ability of the small ship to fly in confined areas, which is also a step toward increased radio reliability due to the shorter range required. Third, the simpler structures involved shorten building and repair time. Fourth is low cost. Of course, the family peace and quiet that occurs when no one has to dodge big wings, fuselages, and assorted paraphernalia in the workshop and family car is no small item either!

The old theory that you need a big ship for visibility has been well exploded as experience has proven that the "maneuvering visibility" is almost proportional to the size of the ship. In other

words, a small ship is capable of making as many turns within its visibility range as the big clunker. Of course, if you are interested mainly in cross-country flying, the small ship is not so good, but the writer holds to the idea that the cross-country event is just a contest to see who has the most powerful transmitter and owns a set of binoculars. Contestwise, even if the wind is blowing, the small ship will compete with the average big ship on surprisingly even terms. The small-field ability of the small ship is ideal for sport flying as you can pick your weather due to the greater selection of close-in fields.

In approaching the design of the small R. C. ship, the primary point to consider is the control weight or "pay load" the ship will have to pack. This "pay load" consists of receiver, batteries, control, and wiring. The planning and decisions involved in designing a ship to carry this load, which may run over 50% of the total weight, poses one of the problems that helps lift the R. C. field far above the usual modeling endeavor.

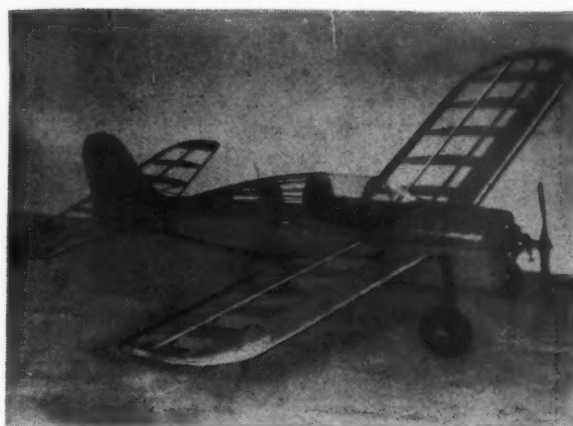
A brief outline of these "pay load" problems is in order, and the first object to consider is the receiver. In the small ship field the only practical receiver available today is the RK61 type (considering the top size limits of this class to be 48" span and .09 cu. in. displacement). Weights of these receivers will run from 2 oz. for the Control Research or Aerotrol, which use the lighter but more expensive Kurman relay, to 3 1/4 oz. for the sets using the cheaper (if bought surplus!) but more rugged Sigma 4F relay. This



The 33 posed with a "giant" 5' ship, O & R 23 powered. 13 1/2 oz. vs. 3 lb. 15 oz!



The author with midwing version of 33, which resembles Goodyear racers.



33 framework was simple—entire top of fuselage was removable

type of receiver, while the lightest on the market, has proven rugged and reliable when properly handled. Its small size, low drain, and simple operation make it a natural for baby R. C. flying. (See the October '49 issue of *M. A. N.* for operating hints.)

Number two design point is the battery supply necessary to keep the airborne equipment in operation. This supply must be chosen with care so that you arrive at an adequate supply for reliable receiver and servo operation and yet are not loading the ship any more than necessary. This means at least enough battery supply to last several flights, if not the entire day's flying. Battery changing can soon get to be a nuisance, and this type of operation is too marginal; you are apt to find the ship up a couple of hundred feet with no control, due to low batteries. Because of the low drain on the "B" supply, from 1.4 to 1.6 ma. idling or .2 to .5 ma. under signal, the smallest "B" batteries available are more than adequate. The "B" supply then consists of two 22 1/2 v. Eveready 412's or two 30 v. Eveready 413's or their equivalent. The 60 v. "B" operation is commonly used when the tube becomes aged. "Charging" will extend the life of these batteries in actual use far beyond the usual shelf life. We have a set about one year old that is still putting out 44 v! These batteries will weigh 2.4 oz. for a set of 412's or 2.9 oz. for a set of 413's.

All low voltage batteries, both A and servo, are the familiar pencil type, or the new silver-zinc Venner Accumulators, which are available from England if

you are fortunate enough to have a correspondent to dicker for you. Use of the pencil is made economically practical with the previously-mentioned "charger" practices. Use of the "charger" cannot be overrated. As a conservative estimate it will increase the life of a pencil some 400%.

The "charger" is compulsory when using the Venner Accumulators. These are a new type of storage cell which will not spill; in fact, only five drops of liquid are in it when fully charged. There are no corrosive fumes during charge or discharge unlike the usual lead-acid cell, and it does not hurt to leave a silver-zinc cell fully charged, partially charged, or fully discharged. A cell weighing .6 oz. is rated a .5 amp. hr. when fully charged. At 1 1/2 to 2 v. per cell, it is a real electric powerhouse in miniature. A single pencil or Venner is entirely practical for the 50 ma. drain of the RK61 filament, with an occasional voltage check during the day's flying, and it should last several sessions if touched up by the "charger."

Escapement operation will require from two to four cells. Actually no more than two are required on a common type escapement, if you are willing to put the necessary work into adding an economy switch. This means a total of three to five pencils for filament and servo together; therefore, the low-voltage battery weight is a maximum of 2 1/2 oz. and a minimum of 1 1/2 oz.

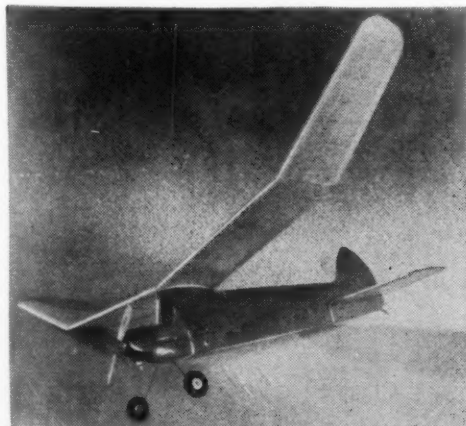
The third item of the control unit is the servo. For our simple and light ships, the escapement or some variation of it is the

obvious choice. These simple units have won more Nationals than all other types of control put together; they well deserve their popularity for simple and economical operation.

The various forms of the common types of escapements have been thoroughly discussed in *M. A. N.* from time to time so that everyone is familiar with the mechanics; however, a brief discussion of the merits of each type is worthwhile.

Rudervator and particularly *Superrudervator* are undoubtedly tops in giving the most control for the simplest installation. Coordinated elevator-rudder on turns, plus elevator action, plus two-speed engine and shut-off (if you are man enough to try it on one of these small engines!) is a lot of control for 1 oz. of weight. The economy switch used on *Superrudervator* and described in the September 1950 issue of *M. A. N.* is applicable to any escapement, and it's well worth the work of installation. This switch gives the two point *Control Research* or *Aerotrol* type of escapement a slight edge over the standard four point *Beacon* type because of the simple automatic neutral and removal of the original objection to the high battery drain when holding a control position. The one penalty is the lack of in between positions for additional control use.

The four point *Beacon* type of escapement, which Walt Good has pioneered and with which he has had so much success, is slightly more complex to fly since you have to signal for neutral positions. It is, however, tops in the low-drain field (Turn to page 38)



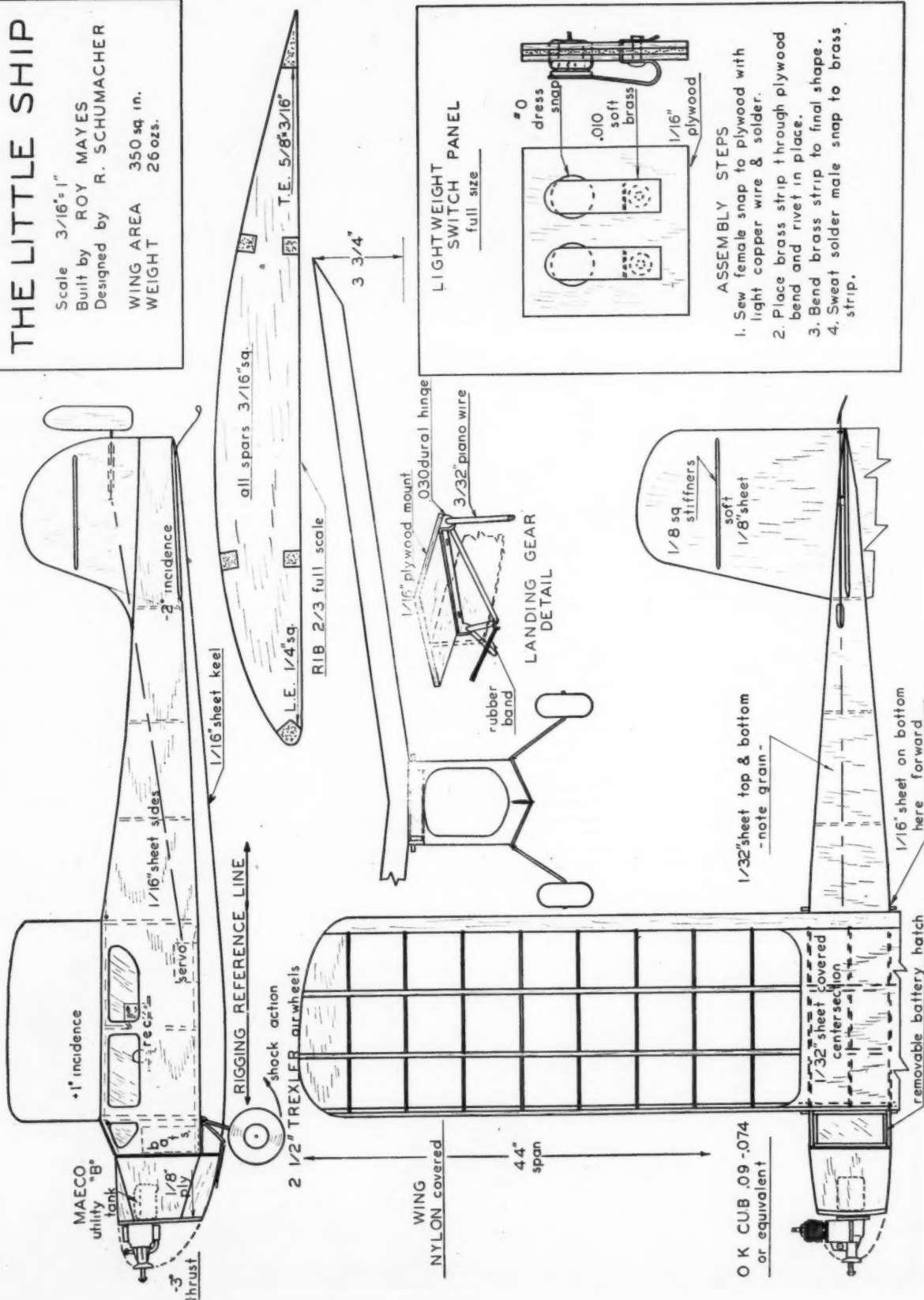
300 sq. in. midjet by John Worth weighs 24 oz.



Bill Butler's Floater Bug has large span but moderate wing area

THE LITTLE SHIP

Scale 3/16"=1"
Built by ROY MAYES
Designed by R. SCHUMACHER
WING AREA 350 sq in.
WEIGHT 26 ozs.



design forum

by CHARLES H. GRANT

LONGITUDINAL stability is no problem to control line fliers. Operation of the elevators by the control lines makes consideration of this factor unnecessary. If the model is out of adjustment longitudinally, a flip or two of the wrist during flight corrects the trouble. Consequently, control liners who have graduated to free flight are often at a loss to know just how the wing and stabilizer should be set for proper flight stability. Usually the best setting and one which may be termed a universal rule is to provide a difference in angle between the wing and stabilizer of $2\frac{1}{2}^\circ$ when the thrust line is immediately below the center section of the wing. With the thrust line very low as in pylon models, this difference may be as little as $1\frac{1}{2}^\circ$.

The common set up for the former situation is to place the wing at $2\frac{1}{2}^\circ$ and the stabilizer at 0° angle of incidence. In pylon models the stabilizer may be set at from $1\frac{1}{2}^\circ$ to 1° positive and the wing at from 1° to 2° positive. These settings refer to stabilizers with equal upper and lower cambers, or flat stabilizers. An average layout is shown in Fig. 1, where the stabilizer is set at 0 and the wing at $2\frac{1}{2}^\circ$. If the stabilizer is flat or uniform camber, the actual lifting angle of the wing will be approximately $4\frac{1}{2}^\circ$, because wings of medium camber start to lift at -2° angle of incidence. So, with the wings set at $2\frac{1}{2}^\circ$ positive, the lifting angle is the sum of these two, or $4\frac{1}{2}^\circ$.

Fig. 1 shows the arrangement of wing and stabilizer with $2\frac{1}{2}^\circ$ wing angle and 0° stabilizer angle. Here, there is no lift or downward pressure on the stabilizer in normal flight. The weight acting at the center of gravity, C.G., is directly under the lift, arrow L_1 .

The mystery is, how does such an arrangement provide longitudinal stability? If the stabilizer is at 0° , there is no pressure on it either upward or downward during normal flight. However, when the model starts to climb or noses up, we will say 2° , then the wing is acting at $4\frac{1}{2}^\circ$ and the stabilizer at $+2^\circ$. At $+2^\circ$ the stabilizer gives considerable lift (arrow S) equal to the original lift of the wing L_1 , per square inch of area. In the climbing attitude with this increase in angle of incidence, the lift moves forward to arrow L_2 and increases in proportion to the length of the arrow, shown. So now force L_2 times distance M_1 represents the disturbing moment. The stabilizer lift S , times M_2 , represents the corrective moment. L_2 is less than twice L_1 because the angle of attack has increased only about 45% of the original lifting angle of $4\frac{1}{2}^\circ$. On the other hand, the corrective moment of the stabilizer is extremely large in proportion to the disturbing moment, so the stabilizer is lifted and the airplane assumes its normal flight position again. The reverse of this action takes place when the airplane dives.

This angular arrangement between wing and stabilizer is the basic principle upon which all longitudinal stability in airplanes is founded. Many aeronautical men prefer to refer to this condition as trim. In any event, the difference in angle between the wing and the stabilizer is the factor which causes the airplane to right itself longitudinally and is based upon the fact that with this setting the lift on the stabilizer increases faster than the lift on the wing and to a greater extent, when the airplane noses upward. A pressure occurs on the top of the stabilizer for similar reasons when the airplane dives. In both cases these tail forces serve to bring the airplane back to level flight.

It is the custom today to make model stabilizers with positive camber, using a regular wing section. This type of stabilizer gives lift even though the angle of attack is 0. Like the wing, it lifts at approximately -2° angle of attack (with medium camber). If such a stabilizer is set at 0° angle of incidence, as was the flat stabilizer in figure 1, actually it will lift, instead of exhibiting a neutral lifting condition as did the flat stabilizer. To provide the same trim conditions as were had with the flat stabilizer this cambered stabilizer must be set at about -2° as indicated in Fig. 2. (The actual

(Turn to page 52)



FIG. 1



FIG. 2

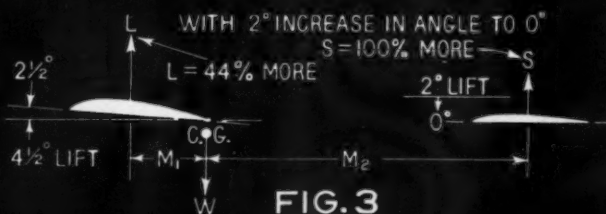


FIG. 3

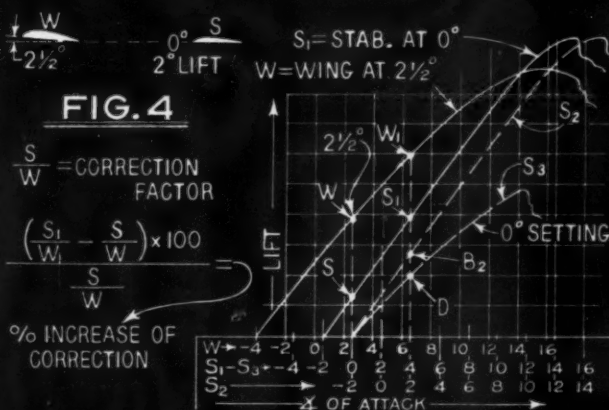
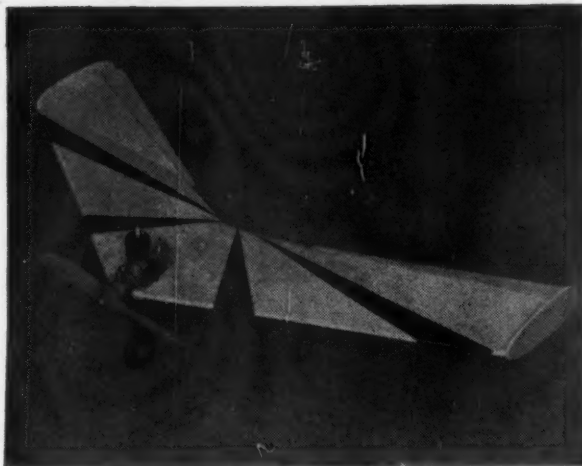


FIG. 5



Model Number 12 heads for the clouds



This is wing No. 2, the only controller in the series

by DONALD C. BROGGINI

The author strove to design a flying wing merely as good as conventional contest types—the final result was even better

THE flying wing can no longer be looked upon as a freak or novelty with the advent of such craft as the Messerschmidt 163, the various Northrop flying wings, the Chance Vought F7U, and in the model field several commercial control-line kits. With its virtual absence of parasite drag, achieved by the elimination of fuselage, stabilizer and sometimes even rudder, and the fact that it is a very clean design with the entire airframe contributing lift, the flying wing represents the ultimate in aircraft. Yet despite the great potentialities of the flying wing, little has been done with it in the free flight model field. Sure a few flying wings have appeared, but most of them were not of even average performance. The mere fact that they flew at all entitled them to be rated a success.

After seeing and building nothing but pylon models since 1939, I decided late in 1948 to see what flying wings had to offer. It was felt that if a stable non-critical wing could be made, even if it were of just average performance, it would be well worthwhile. The simplicity of building a wing and attaching a motor to it to complete the craft proved intriguing. Also in the case of a flying wing, the entire structural weight of the model is concentrated in the wing itself, thus resulting in a strong craft. In addition, the potential of which a flying wing is capable might be approached or attained, and would result in a craft of

superior performance.

In all, seventeen models were made with many major and minor changes. The result was even better than that hoped for. Not only did they prove amply stable, even in windy weather, and non-critical with regards to adjusting and retaining the adjustments, but a number of the designs proved to be fine contest ships, placing against the pylon jobs of this era in eight out of the ten free flight contests entered through 1949 and 1950.

The problem of designing a model plane like the full size craft is not an analytical one, such that it is possible to sit down and figure out the best design for an aircraft. Therefore, the most reliable method of arriving at a satisfactory design was employed, that of actually trying a variety of designs and ideas and finding out the reasons why they did or didn't work. This article covers some of designs tried, both successful and unsuccessful, the author's reasons for their success or failure, longitudinal stability, lateral stability, determination of correct C.G. (center of gravity) placement, a discussion of airfoils, size of the planes, plus a few general tips on flying wings.

Let us review the significant types of models in chronological order. The preliminary work consisted of swept-back or swept-forward paper or balsa glider and rubber powered models. From this point a towline glider was constructed. The second step consisted of making a gas

powered flying wing. There was just one point that was held as a prerequisite for all gas powered models—that was that the craft be a tractor, not a pusher. This would eliminate the difficulty involved in clearing a pusher prop during launching. It also would eliminate the need for carving "left-hand" props since very few modern motors can be run backwards. A U-control model was constructed so that longitudinal stability (stability in tumbling or pitching) could be checked without having to be concerned with lateral (i.e. spiral or directional) stability. The craft had a swept wing with a 5% symmetrical airfoil, and was powered by an Ohlsson 23. The outer portion of the wing had 7° washout (less incidence at wing tip than root). It flew very well right from the start, with the C.G. as predicted. The location of the C.G. is the key to longitudinal stability. A graphic method for determining the correct location of this point will be discussed later.

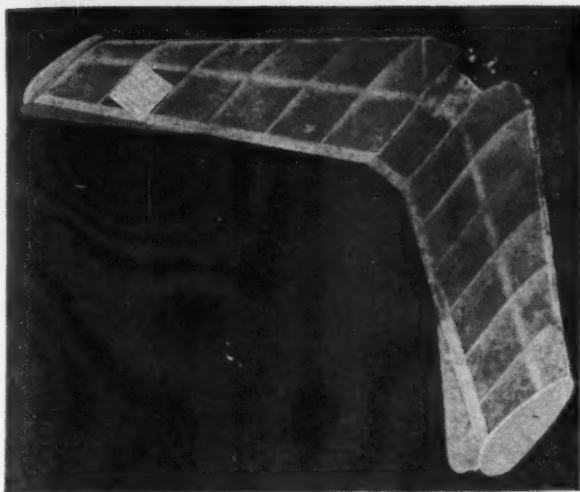
About this time the .020 *Infant* came on the market. This afforded an excellent means of experimenting with free flight designs. The third plane (see picture and sketch) was a 26", 3 1/2 oz., 125 sq. in. *Infant*-powered craft with vertical tip rudders and straight dihedral. The wing had a stable airfoil section, the NACA 2R.12 with washout. This craft was a free flight model, as were all the succeeding models, and while having good longitudinal stability, revealed lateral instability under power only. It would start out nice enough, but after attaining a little altitude would gradually work itself into a tight-banked circle in either direction, neither gaining nor losing altitude. On one flight, the ship, after flying for about a minute in tight left circles, was disturbed by some gusts and was thrown to the right. The craft thereupon continued its flight for about another minute but in tight right circles. When

Design 6, the Gull, had some contest success

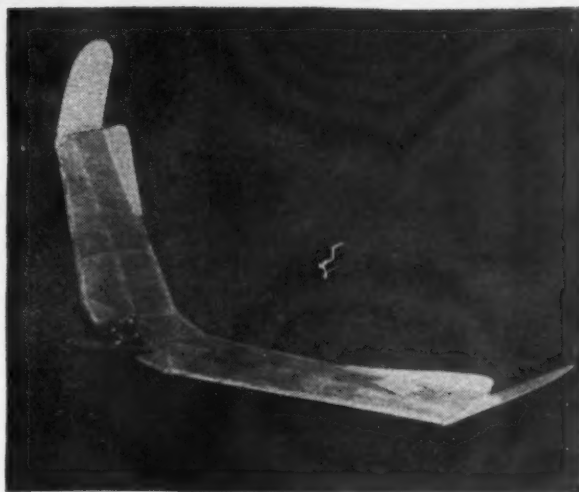


Cathedral center section proved successful on ship No. 12





No. 3 wing had wing tip plates was laterally unstable under power



Modified by substitution of upraised tip rudders, this is No. 3A

PART ONE

the motor cut, the ship went into a normal glide. Since the maneuver could be performed in either direction on the same settings, it eliminated the possibility that the effect was due to torque or gyroscopic action. The rudder areas were reduced and their shape changed without success. This plane was then modified (plane No. 3A) by removing the vertical tip rudders and adding flat upraised tip rudders so that it looked like a polyhedral wing. This seemed to do the trick. The plane had a slow steady turning climb.

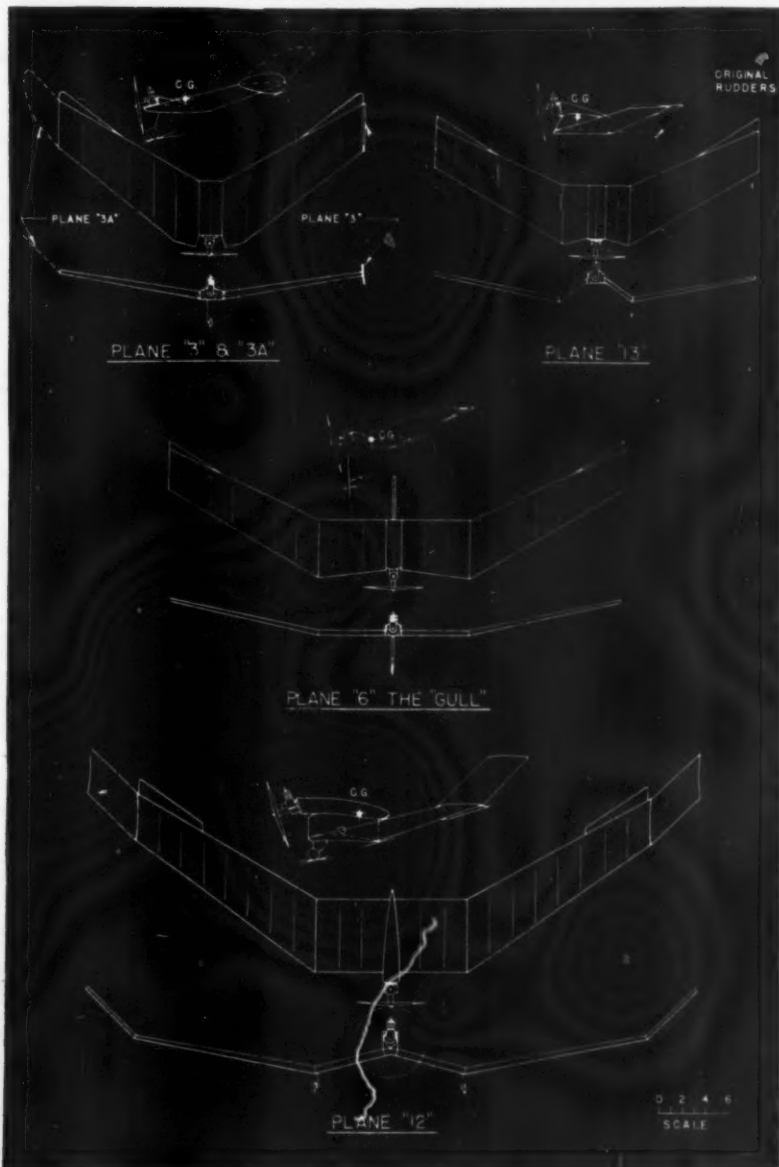
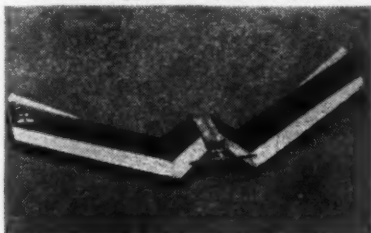
Having what looked like the solution, plane 4 was built; it was a larger, lighter, and cleaner version, having 150 sq. in. of wing and weighed 2.5 oz. This plane climbed faster than its predecessor and revealed a slight tendency toward the same lateral instability, again under power only. It was very much better than plane 3 however, and a number of fine flights were had.

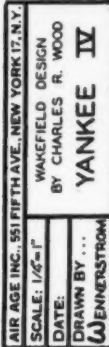
At this point a variety of rudder arrangements were tried and finally the design of plane 5 emerged. This had twin rudders hung from the outer edges of the center section similar to the original plane 13. The rudders were below and aft of the trailing edge. The wing plan-form of planes 4 and 5 was very similar to that of plane 6 (see sketch). Plane 5 which weighed and had the same wing area as 4 was completely stable both under power and in the glide.

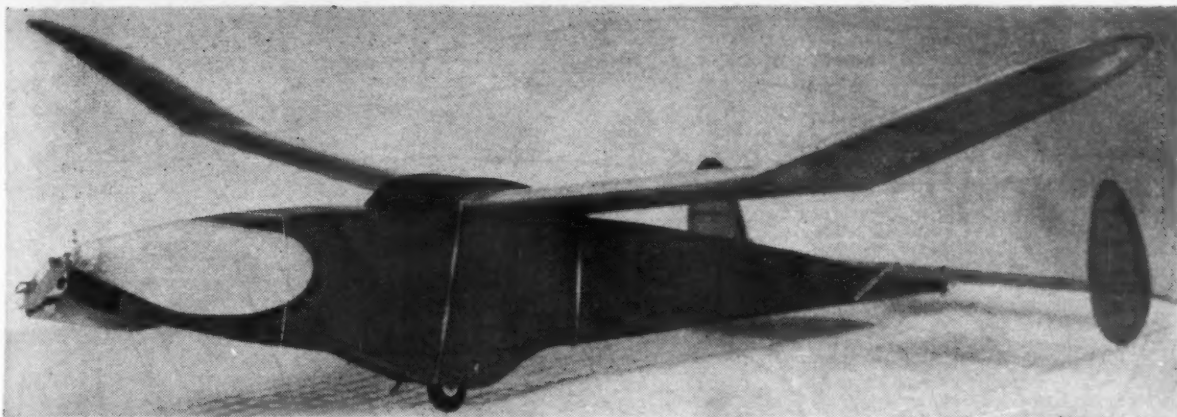
Plane 6 which I called the *Gull* (described in *MODEL AIRPLANE NEWS*, March 1950 issue) was constructed and powered by an .020 *Infant*, as were the others. This plane was larger, cleaner and lighter than its predecessors, having 160 sq. in. of wing area and weighing 2.1 oz. Planes 5 and 6

(Turn to page 46)

Plane 13, a rugged *Infant*-powered sportster







yankee IV

by CHARLES R. WOOD

This plane has been widely copied and has been proven highly successful

YANKEE IV is the end product of nearly two years of experimenting, designing, building and flying to evolve a practical and consistent Wakefield model. In some respects *Yankee IV* is a bit unusual. The unbraided rubber motor, the long fuselage with blisters, the retractable, (but absolutely reliable) landing gear, and twin rudders are all features that were incorporated from lessons learned on previous Wakefield models.

The fuselage is longer than on most any Wakefield type except Ellila's '49 and '50 Wakefield winners and Dick Schumacher's *Long Tom*. The long fuselage is definitely an advantage in rubber powered models, provided the weight and drag can be kept down. It has long been a popular misconception that a long fuselage type model would weathervane in the wind and generally be unstable. However, just the opposite has been found true. *Yankee IV* has been the most consistent rubber model the author has ever built and this includes kit and original designs over the last ten years. Actually, a long fuselage is excellent for a Wakefield type because it allows a very long tail moment arm, and with a 33% stabilizer this is a big help in making a super stable model. Charles Grant brings out this fact again and again in his book, "Model Airplane Design—Theory of Flight."

The fuselage does not suffer from excessive drag because two blisters beyond the normal fuselage line make up the cross section required (O. A. L. squared, divided by 100). The upper blister which is really a wing fairing and cabin combined, is affixed permanently to the wing center section; the wing can be shifted for C.G. changes as on a conventional stick model. The lower blister houses the retracted wheel, provides more

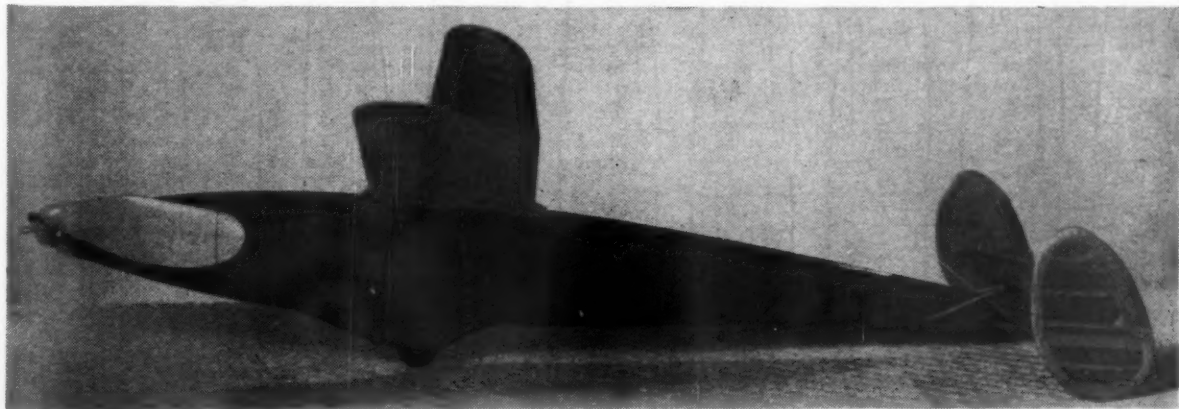
fuselage cross section and also lowers the wheel well below the lower line of the fuselage so that the model slides in without damage to the covering, when landing on rough ground.

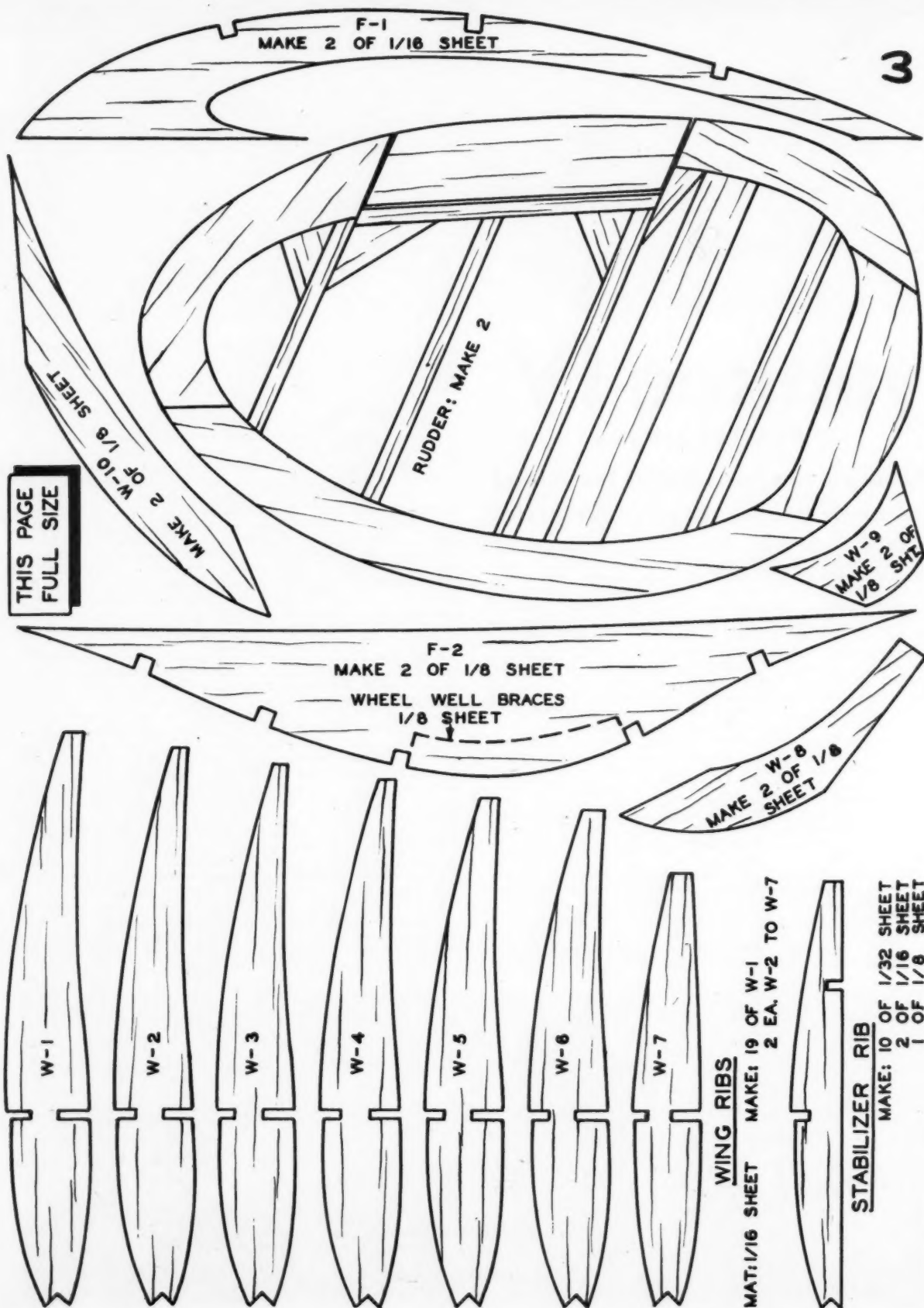
An unbraided motor is used in this model, and again it refutes a misconception, that "a braided motor is a necessity in contest types." Here again the long fuselage is an advantage because of the increased distance between motor hooks as compared to the average 34 to 36" fuselage found on most Wakefields. A braided motor is often used on contest rubber models so that a long motor run may be had and yet keep the fuselage relatively short. However, a braided motor has stored in it anywhere from 150 to 200 tensioning turns that are never really used, and the rubber is under constant strain. Not only this, but the braided motor with from 15 to 25" of slack is heavy, weighing from 3/4 to 1 1/4 oz. over what an unbraided motor with only 3 to 6" of slack would weigh. This added weight is quite a penalty to pay for a slightly longer rubber run. In fact it is more of a detriment than a help. The overall weight of a model goes up considerably when using a braided motor and the increased sinking speed of the glide more than overcomes the slight increase in altitude gained.

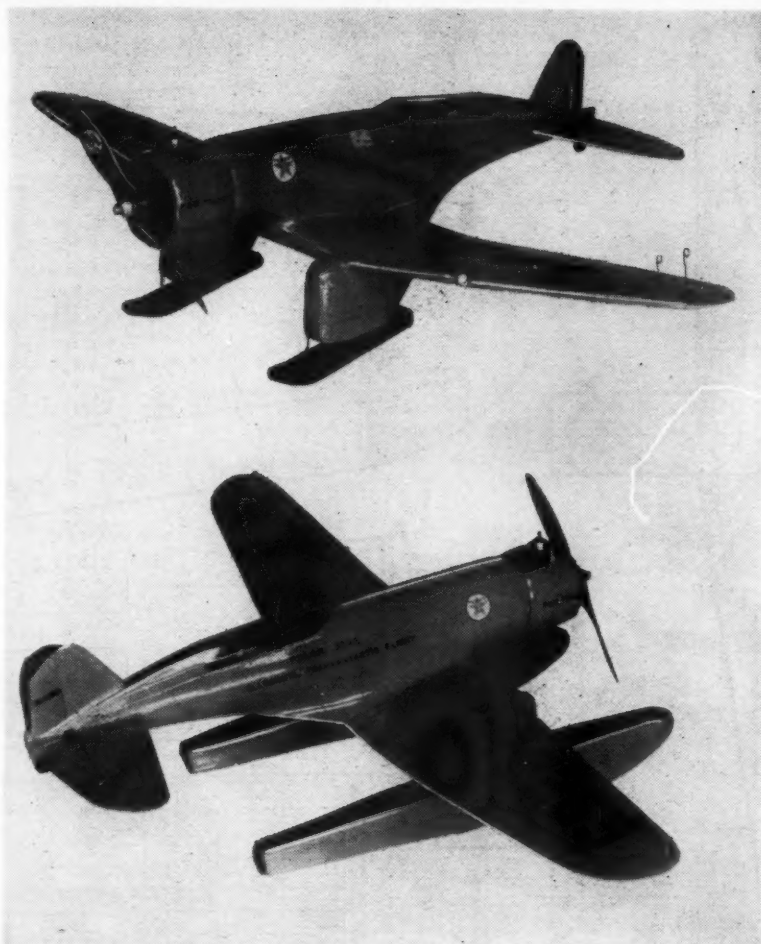
Experiments were carried out with earlier Wakefield models in which long braided motors and short unbraided motors with equal number of strands were used. The short motor won out on all counts. The weight of the complete model was kept down to between 8 and 8 1/4 oz. as compared to between 9 and 9 1/2 oz. for a braided motor. The increase in performance with the unbraided motor was quite apparent. The climb was fast and smooth, and the glide was slow and wheeling. Any little riser was sniffed out and the model "rode" beautifully. Average times in fog and calm evening air were from 2:50 to 3:40. The same model under identical conditions with a braided motor averaged from 1:50 to 2:30 and the drift of the model increased due to longer power run on the downwind side of the flight pattern.

The retracting landing gear is quite different from ordinary retracting landing gears in that the wheel stays locked down for the first few seconds of the climb. A retracting landing gear was designed into this model to keep it aerodynamically as "clean" as possible as it was felt that quite a little drag came from the normal fixed gear. This is not just theory. The model has been flown many times with the landing gear down, and flight times have proved that this causes both sluggish climb and

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The optional built-up floats or easy-to-make plastic skis will interest all experimenters.

polar star

by D. A. NEWELL

Lincoln Ellsworth's famous Northrop makes a perfect control model

THE Smithsonian Institution (Aircraft Building) is the final resting place of most record breaking or otherwise famous airplanes of the United States; Lindbergh's *Spirit of St. Louis* and Wiley Post's *Winnie Mae* are a few of the famous planes that share this honor. Among the airplanes in this exhibit is a bright orange colored, sleek looking airplane equipped with skis. On the fuselage side can be seen the words *Polar Star—Lincoln Ellsworth Transantarctic Flight* lettered in black. It was in this Pratt & Whitney *Wasp* powered Northrup plane that the famous explorer Lincoln Ellsworth flew over the South Pole on November 23, 1935 from Dundee Island in the Wedell Sea to Little America, Bay of Whales. The plane was flown with wheels, skis and standard pontoons during its lifetime and the model can be so equipped.

Our model is built to the scale of 2/3" on the model equals 1' on the full size plane. This size allows engines from .099 to .29 cu. in. displacement to be used. We used radial mountings, and most engines today can be mounted in this manner. The wheels and skis are interchangeable within a few minutes. Notice the skis are made from sheet plastic and are bent to shape after heating in boiling water. These proved far superior to wood or metal skis.

The fuselage construction is a combination of carved and built-up construction. The bottom half is the main supporter of fuselage stresses. Begin by tracing the top view and carving to shape. Repeat for the side view. Now, following the fuselage cross sections, carve the exterior of the bottom half to shape and sand smooth. Take care in carving the fillet. The body is now hollowed to the lines indicated.

Cut the tail from the specified stock and sand to a streamline shape. Use a Veco combination control horn and elevator joiner. Install this item now, and hinge the stabilizer and elevator using fabric hinges. Cement the stabilizer to the fuselage bottom. Install the bellcrank and connect the control rod. Cut out the bulkheads and cement in place. Add the upper portion of the carved nose and plank the fuselage top using slow drying cement. When dry sand smooth. Add the fin and rudder. Cement the 1/8" plywood bulkhead to the front of the body applying plenty of cement. The engine will be held in place on this with wood screws. This arrangement worked quite well for us.

The two wing spars are cut from plywood. Notice that the forward spar is the longer. Cement this to the roughly shaped leading edge pieces. While this is drying, cut the ribs and wing covering to shape. Cement the ribs to the bottom covering and then cement this to the leading edge and forward spar. Install the center section first, followed by the outer panels one at a time. Cement the rear spar in place.

Bend the landing gear and attach both pieces to the spars. These are sewed in place around the spars and plenty of cement should be applied. Bind the landing gear joints with thin wire (milk bottle top wire will do) and solder well. The trailing edge of the bottom covering must be bevelled and then the top covering can be added. This is butted against the leading edge and is worked back to the trailing edge. Be sure to apply cement to all the ribs. The soft balsa wing tips are now added and, when dry, the entire wing is sanded to shape.

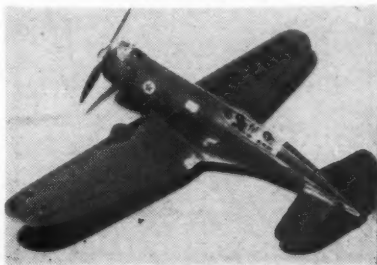
The pants are made of two pieces of 1/2" balsa cemented together lightly and out to external shape. Pry apart and hollow as shown. Reassemble and cement in place onto the wing. When dry it can be cut in half horizontally as shown.

Cement the wing to the fuselage now and fillet well. The cowl is carved from hard balsa or turned from pine. Add the tail wheel and wire fork. Install a control line guide on the inboard wing.

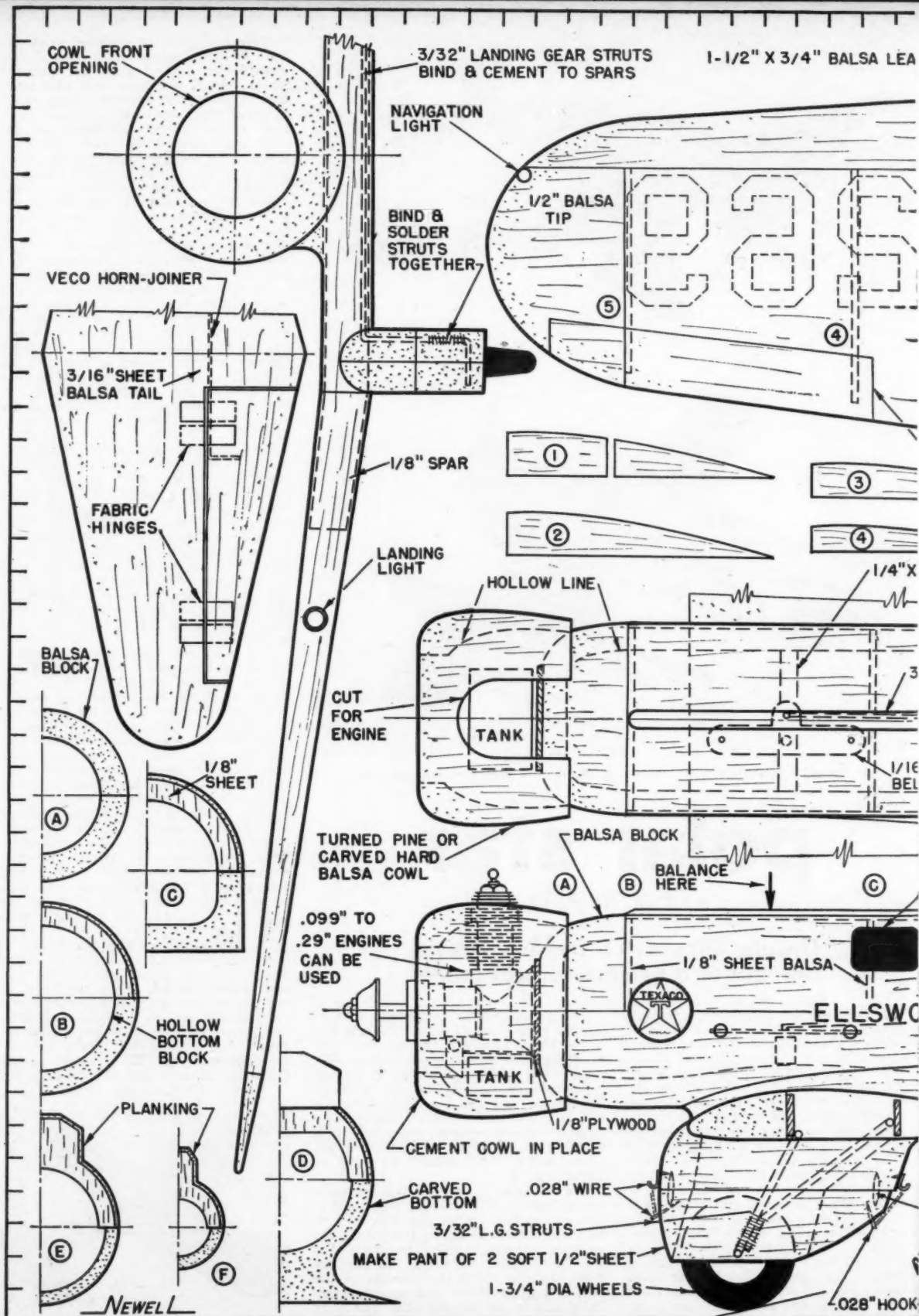
Three coats of sanding sealer should be applied and sanded smooth. The entire plane is colored orange. We used Aero-Gloss fuel proof dope. After three coats we rubbed this down, with a good compound and added *Simoniz*; then the celluloid canopy and engine. Cement the cowl in place. Add all trimming with black Trim-Film.

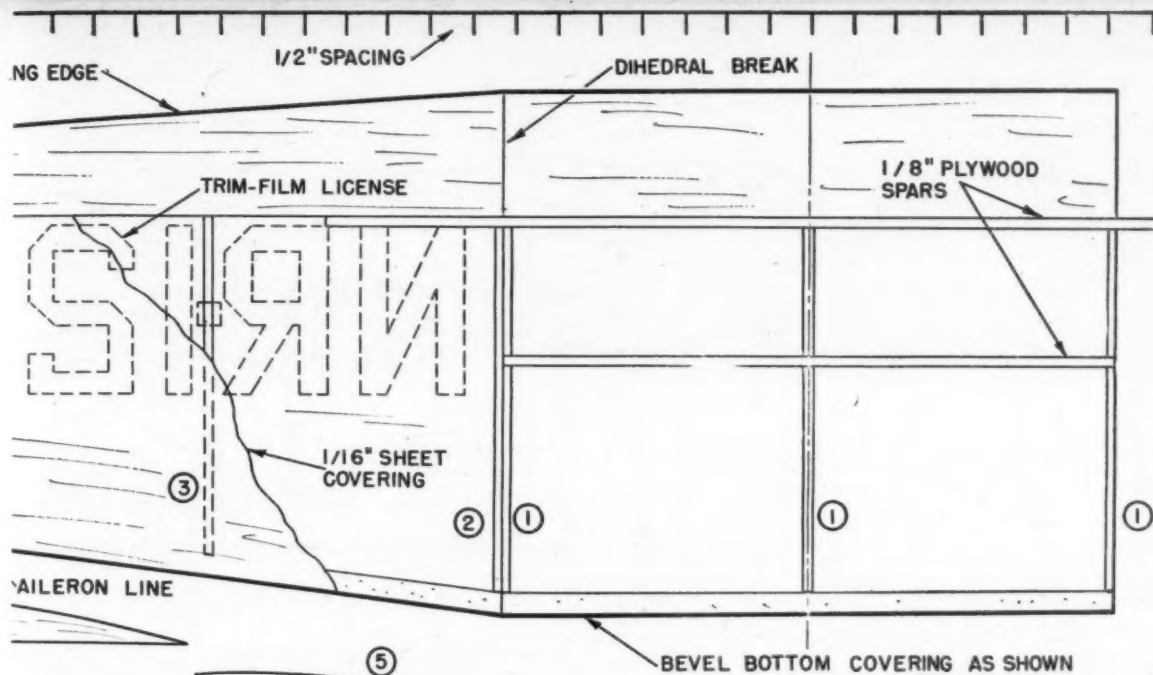
The skis are sheet plastic available at most hobby shops or war surplus stores. These are cut to shape with a coping saw and sanded smooth. They are bent by heating the front portion in boiling water until pliable. Attach the bottom fin strip first before bending. Bend both pieces together for a good fit. When the skis are mounted, the rubber bands should be under tension and should hold the

(Turn to page 37)

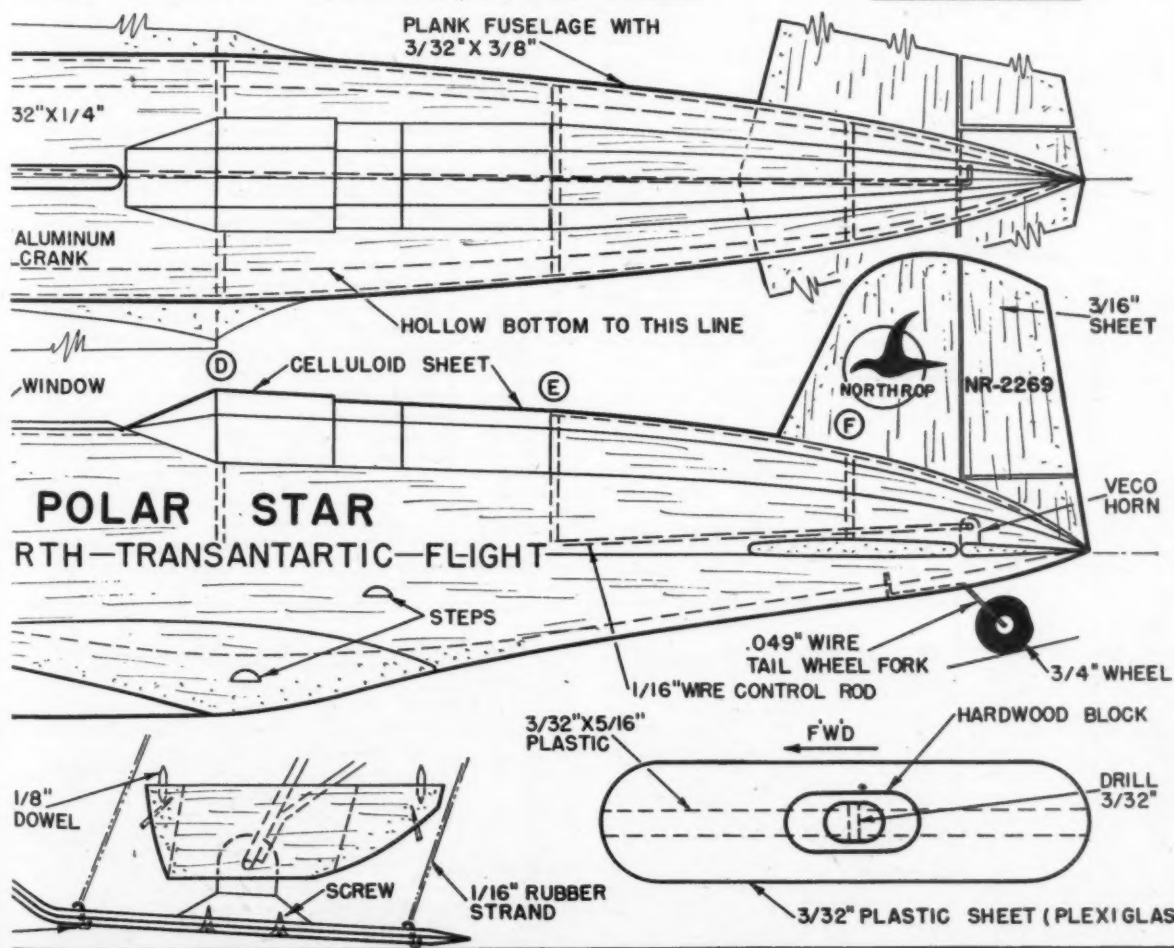


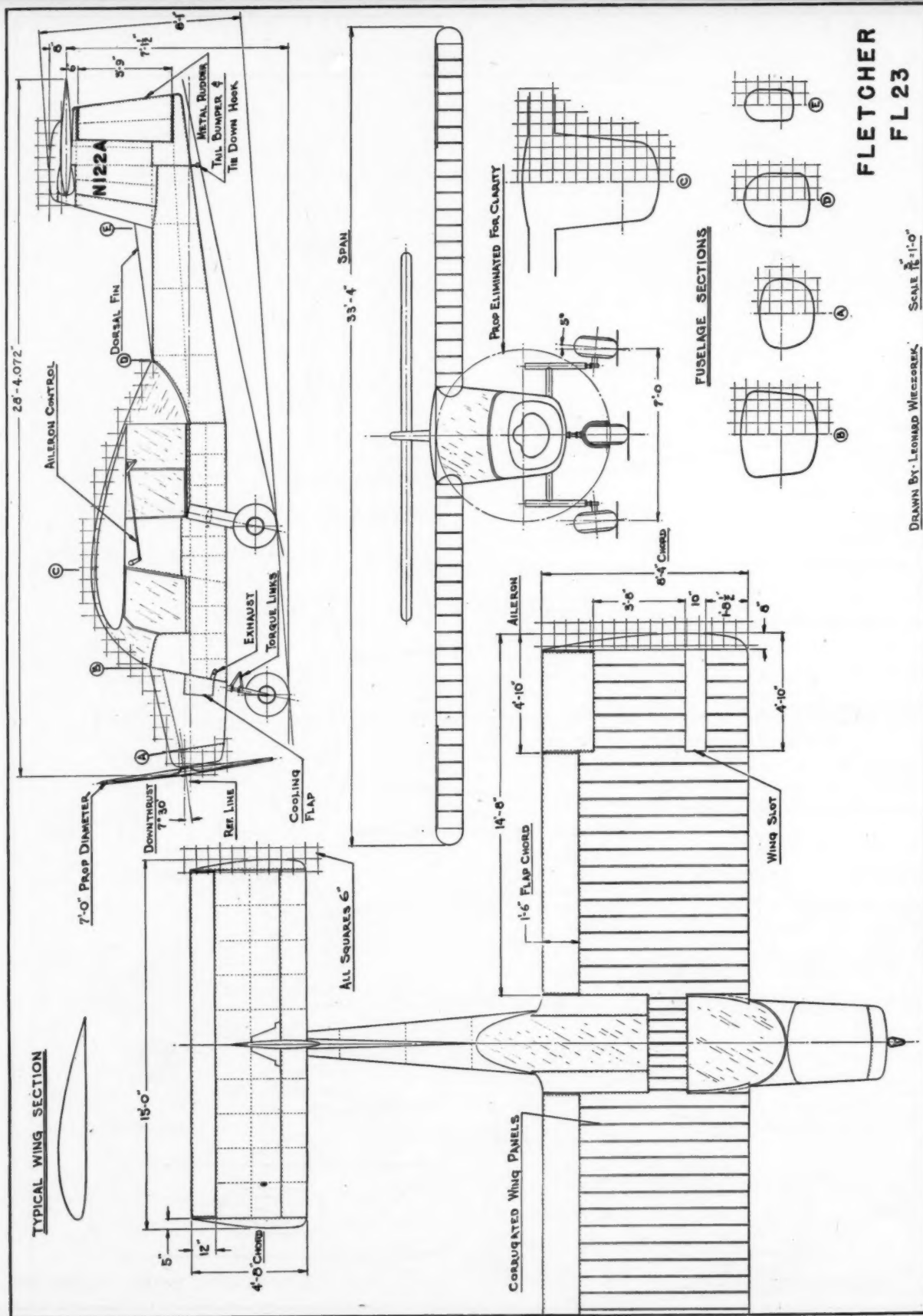
Low wing, neat lines mark this sturdy flier





1/8" HARDWOOD SUPPORT ALL RIBS ARE 3/32" SHEET Balsa COLOR MODEL ALL ORANGE WITH BLACK MARKINGS







fletcher 23

by ROBERT McLARREN

AIRCRAFT design and manufacturing have long since become a truly big business in the United States. Design of huge transports and multi-engine bombers is no longer an expression of the artistry and cleverness of a pale, thickly-glassed young man bending over a table but is the product of thousands of engineers distilling the scientific reports of countless research tests and analyses. The product of this tremendous effort results in multi-million dollar contracts requiring the services of tens of thousands of shop workers and millions of dollars worth of equipment and plant facilities.

Despite these facts, however, there continue to exist a handful of small, tenacious and rigorously independent aircraft companies doing business in the old-style manner. Capital is obtained from friends and speculative investors or simply from a rich and sympathetic uncle or grandmother. Design after design is turned out by an engineering department consisting of as few as two or three engineers, a shop of a dozen men and a single stenographer keeping all of the manifold records. It is such companies who must gamble everything on each airplane built, whose literal self is put into every rivet and bolt as the dream congeals and the physical article makes its first flight.

Fletcher Aviation Corp. of Pasadena, Calif., is such a company. It was created early in 1941 by Wendell, Frank and Maurice Fletcher for production of a tiny two-seat training plane designed by Wendell. The Fletcher FBT-2 expressed a number of novel ideas which the existing expansion in training plane procurement by the armed forces seemed certain to adopt. The tiny plane had a span of only 30' and weighed a mere 2500 lb. fully loaded. It was powered by a Wright R-760-El Whirlwind engine delivering 300 hp for take-off and 285 hp at 2100 rpm for normal rated power. This high power together with the simplicity and cleanness of the little airplane gave it a top speed of 175 mph and a rate-of-climb of 1340' per min. It was distinguished, however, by the fact that the wing and tail surfaces were of symmetrical profiles, thereby permitting the wing panels to be used on either side of the fuselage and all three of the tail surfaces to be completely interchangeable. It

also featured a "Plyweld" construction in which resinous-bonded plywood produced a smooth external surface.

This first product, despite its high performance and novel features, did not prove a success in competition for Air Force and Navy training plane contracts since these went to other aircraft which were larger and slower but docile enough for student primary training. This tiny airplane, however, continued to figure in Air Force technical history throughout World War II and Fletcher never ceased their campaign to prove the trim craft a success.

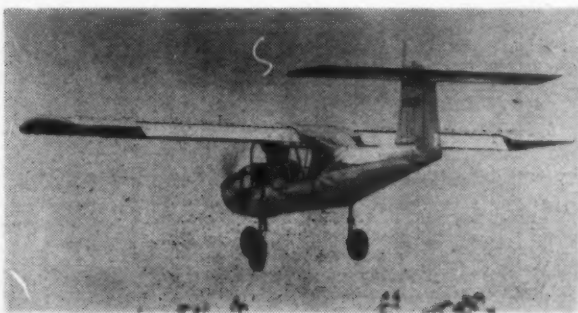
It was shortly after the training plane competition that Fletcher and the Air Materiel Command at Wright Field started one of the most secret and exciting adventures in military aircraft history. So shrouded in mystery have been these developments that only fragments of the story have even yet been told. It all began with the concept of the target airplane by the Air Force Training Command, which decided even before Pearl Harbor that fighter speeds and tactics had outgrown the old tow-target system of aerial gunnery training. What was needed was for fighter pilots to shoot at and destroy actual airplanes in flight. The obvious first disadvantage was cost, and throughout the ensuing program the entire aim was the development of a really cheap target airplane.

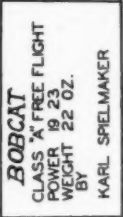
The power of the little trainer was stepped up by the installation of a Pratt & Whitney R-985-AN-1 developing 450 hp and a fixed tricycle landing gear was fitted. This additional power gave the plane a top speed of well over 200 mph and the Air Force awarded an initial contract for 50 of them designated PQ-11, or piloted target airplane. An additional contract for 50 model PQ-11A was made, the model containing provisions for either a pilot or a 1,000 lb. bomb.

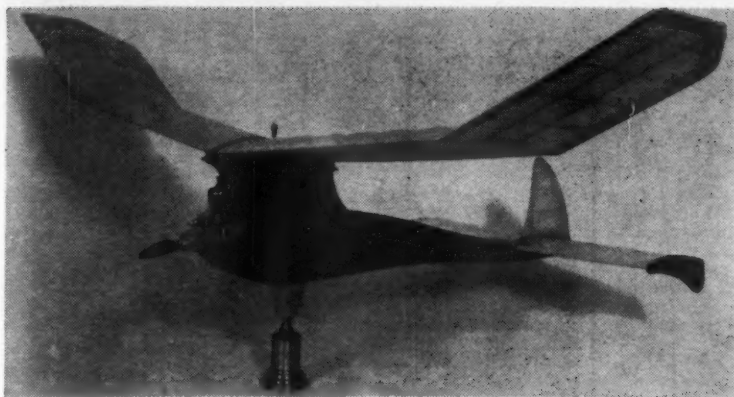
The PQ-11A model represented yet another line of Air Force secret development: the controlled bomb. The target airplanes were equipped for radio control from a nearby control airplane. It was only a step to the placing of a 1000 lb. bomb in the cockpit, and the airplane could be directed right into a ground target by the controlling airplane. The success of the Culver series of target airplanes, the PQ-8, 9, 10 and 14 series, resulted in cancellation of the Fletcher contract, however, and no PQ-11 or PQ-11A airplanes were delivered.

Working closely with Wright Field, however, Air Force and Fletcher engineers decided to abandon the target version of the airplane and concentrate on the guided bomb arrangement. It was decided to increase the bomb size to 2,000 lb. and to remove the engine altogether, resulting in a controlled glide bomb version of the airplane. The Air Force awarded a contract to Fletcher for 10 of these, designated XBG-1, early in 1942 and these aircraft (or gliders) were delivered during the

(Turn to page 42)





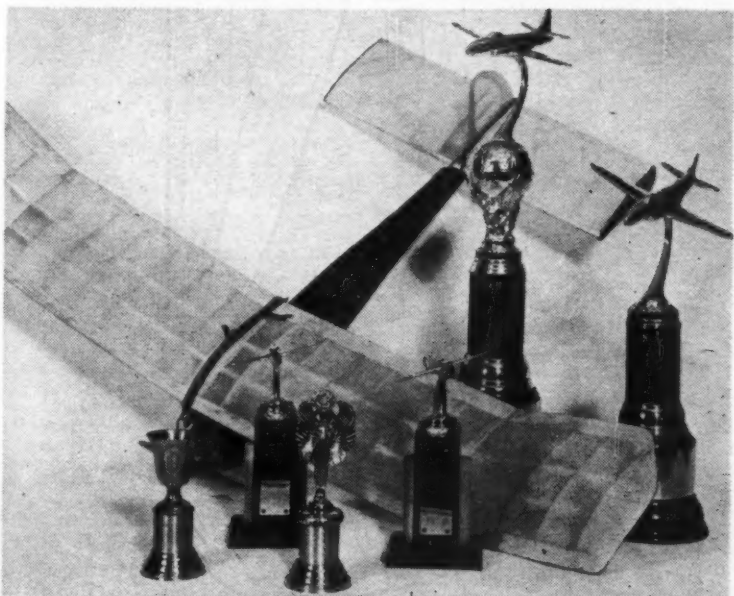


bob cat

by KARL SPIELMAKER



An exceptionally stable Ohlsson-powered free flight with nice climb and good recovery.



HOW many times have you stayed up burning the midnight oil to put the finishing touches on that new super contest job for tomorrow's meet, only to find when you got to the field the next morning that windy weather made flying out of the question? Too many of the present day popular contest ships are only "fair weather friends," ideal for dead calm days but entirely unsuitable for competition in anything stronger than a slight breeze. The high mortality rate of floaters at many contests gives adequate testimony to the fact that too often something is missing in the design of high performance gassies. That something is stability—actually the prime requisite for a consistent contest winner.

The Bobcat was designed with this fact in mind. Incorporating the spiral stability theories of C. H. Grant, the Bobcat has its center of lateral area and center of gravity located on a line parallel to and just slightly higher than the thrust line. This force set-up results in a fast, smooth spiral climb with the wing, and not the prop providing the lift. The recovery at the end of the power run is an easy roll into a flat glide, and no altitude is lost in wasteful stalls and long recoveries.

During the past three years the author and some of his model building friends have built Bobcats of sizes varying from a small CO-2 midget to a 7" class D giant. Slight variations in design have finally produced the latest version presented here. This size has been the most consistent winner with a span of 46" and an area of 320 sq. in. weighing in at approximately 22 oz. and powered by engines of 19 to 23 cu. in. displacement. Besides placing with satisfying regularity in contests in western Michigan, the Bobcat has faced up well to strong competition, taking first place open and second place junior in the 1949 Michigan State Meet.

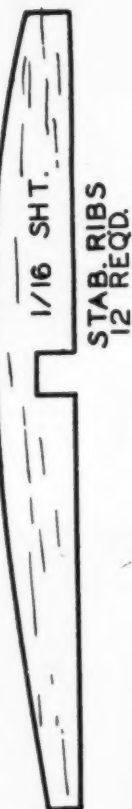
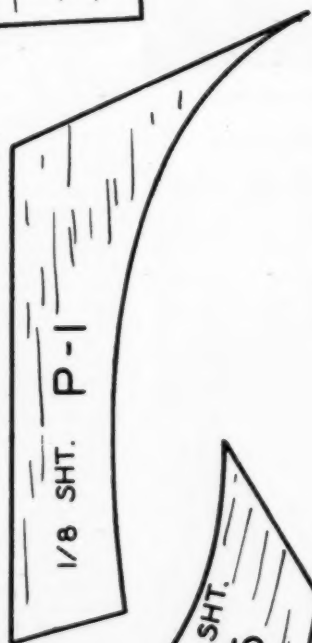
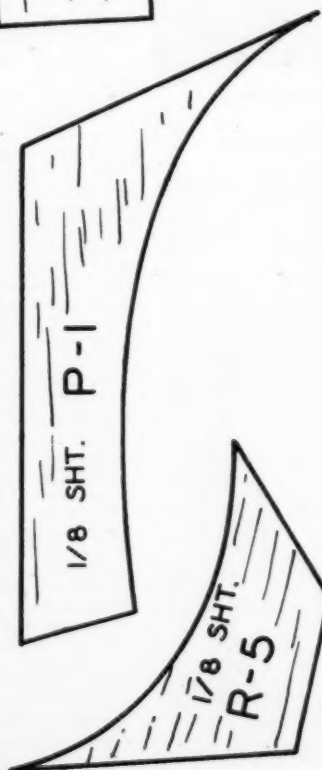
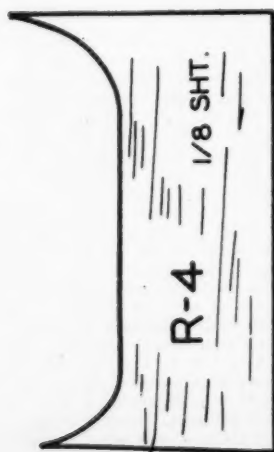
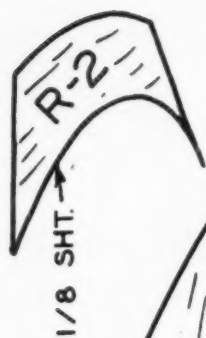
The simple and yet rugged construction of the Bobcat makes it an ideal free flight gassie for the beginner, and its consistently high performance will thrill the old time expert. If you are looking for a contest job that will keep you up in the running in any kind of flying weather, the Bobcat is your baby.

Fuselage: Before beginning any construction, scale up the plans or have them photostated to full size. The fuselage sides are made from two pieces of hard balsa 1/16" x 4" x 36". If the 4" widths are not available, join two pieces of 2" width together, making sure that both pieces are of the same hardness and grain. Carefully trace the fuselage outlines on the two sheets and cut out. Mark the positions of the stiffeners on the fuselage sides and cement them in place. When the stiffeners have dried, locate and secure the 1/2" x 3/8" hardwood motor mounts. Cement a scrap of 1/8" sheet between the fuselage sides at the tail and trim off the excess. Next cut the 1/8" plywood firewall and mount it in position ahead of the forward stiffeners.

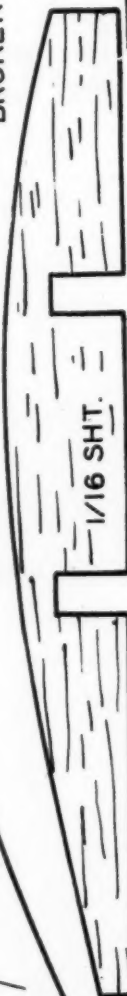
Now you may begin to cement in the remaining stiffeners on the top and bottom. Note that the fuselage width remains constant for two sections behind the firewall. Check this width carefully to be sure that the motor mounts do not toe in or out. When the fuselage is dry, drill the holes for the engine and landing gear, and sand all joints smooth.

You are now ready to plan the top and bottom of the fuselage. If you are not going to use glow-plug in your Bobcat, leave the two spaces beneath the wing mount open for installing an ignition system. Study the detail drawing of the wing mount to become familiar with its construction. A piece of 1/2" x 2" is cemented to the top of the firewall, from the forward portion of the mount. Next add the two top rails of 1/8" x 1/2" to the sides of the mount. While these pieces are drying, cut out piece P-1 from hard 1/8" sheet. P-1 is now located on the top planking so that the trailing edge is 7" from the front of the wing mount.

(Turn to page 43)



BROKEN LINE IS CENTER GUSSET
3 REQD.



BOBCAT
PLATE TWO
FULL SIZE
K. SPIELMAKER

ENGINE REVIEW

torpedo .049

by LES McBRAYER

K & B Manufacturing Company of Compton, California are now producing the newest member of the Torpedo "Family of Champions"—the *Torpedo .049*. This engine has been engineered to compete at the very top level of the Half-A class. Already it has found its way into the winner's circle and has made new entries in the record books.

Starting with the *Torpedo 29* ignition engine and progressing through the .29, .24, and .32 *Glo Torps*, K & B have always given the model builders honest engines known for their performance, stamina, and reliability. When they introduced the *Infant* engine, a whole new era in model flying was opened up. Here for the first time was a compact power plant weighing only 1 oz. that could be put into models as small as 12" in span and weighing about 3 oz.. Modelers were quick to see the possibilities and soon were flying free flight and U-control models of all types. The growing popularity of these small engines created such interest that AMA soon established a special competition class known as Half-A. To help meet the demand for small engines K & B placed the *Torp Jr.* (.035) on the market and now has added a third engine, the *Torpedo .049*. These three engines all have interchangeable mounting plates so that it is possible to change power plants in a model to give varying performance. For instance, a free flight model may be flown with an *Infant* for sport flying or with a *Torpedo .049* for really hot contest performance.

Let's take a look at the new .049 engine. Upon opening the colorful package and noting the contents, it is hard to believe the low price on the box. This combination package includes the *Torpedo .049* engine, Glow Plug, 6"x3P *Tornado* wood propeller, fuel line, detachable fuel tank, *Slip-on Connector* for the glow plug, two service wrenches, Parts List and Instruction Booklet, Certificate of Warranty, and decals for your model. The complete engine (less tank) weighs only 1 1/3 oz. Bore is .406" and stroke is .380". No castings are used in the engine, all parts being machined from bar stock.

The crankcase and the carburetor venturi are turned from aluminum alloy with the venturi being pressed into the crankcase. The needle valve body is made from brass stock and is pressed into place in the venturi. The brass needle valve has a 2-56 thread and has a knurled aluminum knob. The crankshaft is machined from steel and is hardened and ground. Exhaustive tests have proved that the

combination of long bearing area, aluminum alloy bearing, and hardened steel shaft gives extremely long and trouble-free service. The steel drive washer is locked in place on the crankshaft by splined grooves. An important feature of this engine is the large size of the propeller shaft which has an 8-32 thread rather than the 6-32 thread normally found on Half-A engines. This means added protection for the engine in those occasional crack-ups. The aluminum rear cover-plate threads into the crankcase and holds the aluminum mounting ring in place. This mounting ring is free to rotate in any position, freezing in place when the mounting screws are tightened against the bulkhead.

The domed piston is machined from steel, hardened and ground to a beautiful finish. The turned aluminum connecting rod is mounted to the piston by means of a ball and socket connection that eliminates the usual wrist pin holes in the piston. This allows more porting area and decreases cylinder-wall wear. The steel cylinder has two large by-pass ports and two large exhaust ports and is threaded into the crankcase. The aluminum head threads into the cylinder and is threaded to take a conventional short glow plug. The two-piece aluminum fuel tank is mounted in place beneath the crankcase by a 4-40 machine screw passing through the tank. When it is desired to use an internal fuel tank behind the engine, the regular tank can easily be removed. The precision machine work and close tolerances on all parts of this engine make the use of gaskets unnecessary.

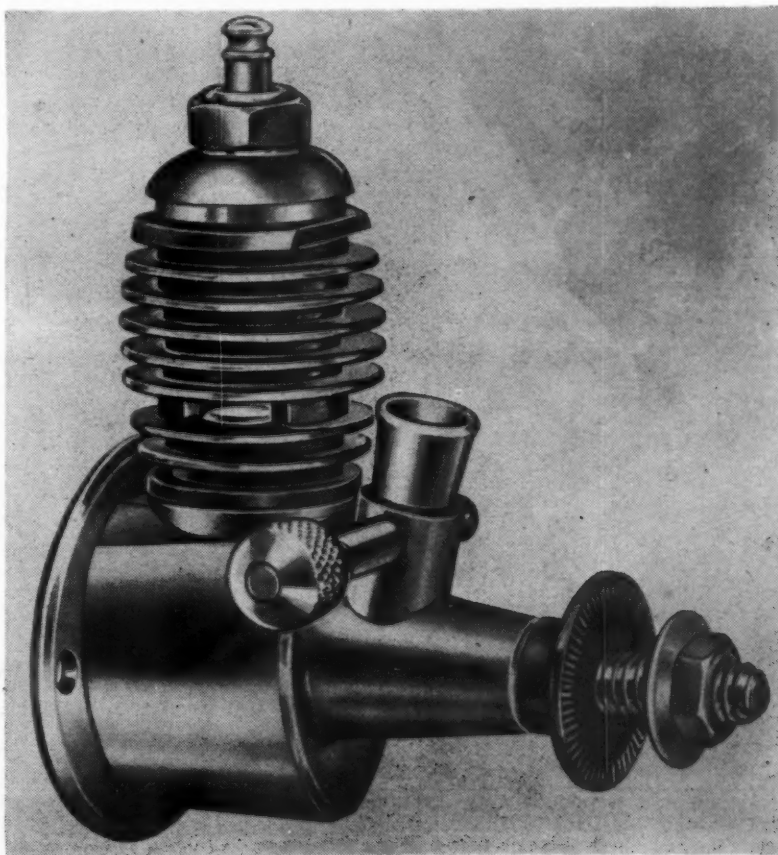
As with any new engine it is a good idea to read carefully the instruction booklet for suggestions on the operation

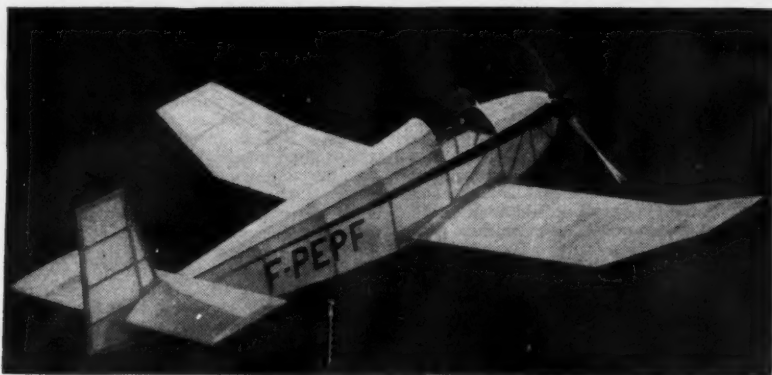
and care of the engine. K & B recommends that *Supersonic 1000*, *Supersonic Ultra Glo*, *O & R AA*, or *Testor 39* fuel be used in the *Torpedo .049* engine. Starting the .049 was found to be very easy, regardless of whether it was cold or really hot after a high-speed run. Compression is still good even when the engine is hot. Various engines probably will vary in break-in time from a few minutes to an hour or more. The particular engine tested here required about 45 minutes running time before it would hold a lean adjustment and really wind up. An unusual feature of this engine is that it can be turned-up to terrific speeds for U-control model flying or it can be turned much slower with a large free flight prop and still deliver great pulling power. The test engine was easy to adjust to a peak running speed and ran consistently at top speed, once it was broken in thoroughly.

When flying a model with a *Torpedo .049* for the first time, be prepared for a lot of speed and power. A U-control model that had been flying with a *Torp Jr.* for some time was tested with the .049. We found a considerable increase in speed, the ability to do maneuvers that couldn't be done before, and a very steady run in the air from beginning to end of the flight. Electric stroboscopes showed the following:

6"x5p	Power Prop	10,300 rpm
5 1/2"x4p	Power Prop	12,500 rpm
6"x3p	Tornado Prop	12,500 rpm
5 1/2"x3p	Plastic Prop	14,000 rpm
Air-O	Single Blade	16,800 rpm

Dirt and dust are the biggest enemies of any model engine. This is of even greater importance in the Half-A engines which are built with extremely fine tolerances. (Turn to page 37)

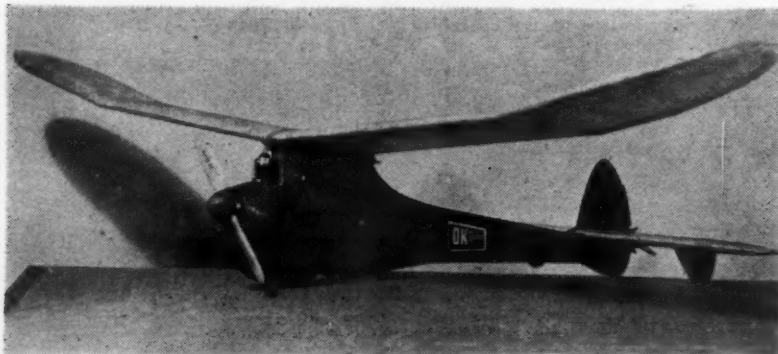




No. 1 Beautiful model (and photo) of French lightplane Bebe Jodel by Sherman Gillespie



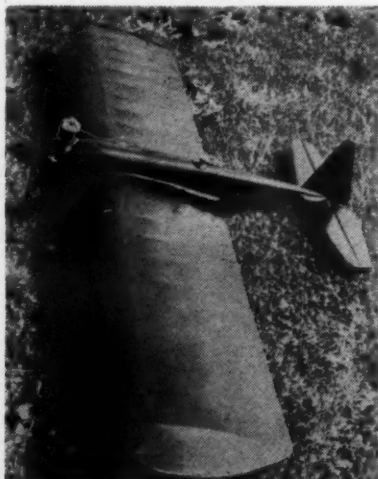
No. 2 C. L. Kemp produced this free flight scale Camel; 47" span and Bantam 199 power



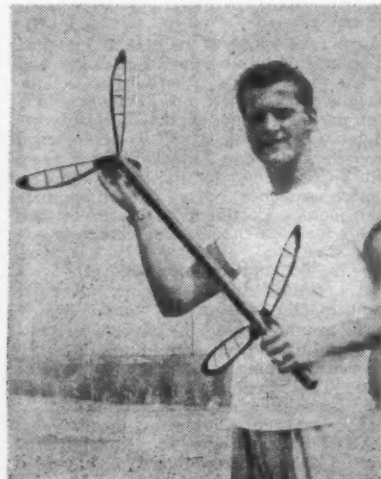
No. 3 A. G. Lennon has had good contest results from this Cub .049 powered original



No. 4 Ivan Gause with his ROGue in Sweden



No. 5 Orwick-powered stunter of Lloyd Carter



No. 6 W. Skotchdopole with favorite helicopter

air ways

News of Model
Builders from All
Over the World

PLYMOUTH RECORD-BREAKERS totaled fifteen, we learn; after a checking of records, AMA has confirmed this number of new holders. One flier, Richard Modler of Dayton, accounted for three himself. Competing in the Junior Division, he made a time of 24 min. 20 sec. in A gas free flight, and hit 141.78 mph in D speed.

According to the AMA, the Detroit event was tops in number of records broken, quite an accomplishment for the individual breakers when you recall that this meet includes only top-grade fliers chosen for skill and accomplishment.

Records were set in C Senior Indoor Cabin, Junior Outdoor Stick, Junior Outdoor Cabin and many others. Five of the new records were in Speed, four in Outdoor Rubber, four in Free Flight Gas, and two in Indoor Rubber.

1/2A PAA-Load event will now be made official. Mr. George Gardner of PAA informs us that the event, which was tried out informally at the 1950 Nationals and elsewhere this season, worked out so nicely that it is now to be considered definitely in. Addition of 1/2A raised the old specter of adding additional events and classes to the already crowded contest roster. Mr. Gardner made many inquiries of experienced fliers and contest officials, and it was indicated that the present B Class in PAA-Load flying could be dropped. The new set-up will thus have only 1/2A and A events. The 1/2A dummy has been changed a bit, and as this is written, a final weight has not been decided upon, but some fliers felt it should be as high as 4 or 5 oz.



No. 7 Warren Shipp produced this Skimmer amphibian with enclosed engine

All these problems will be thrashed out, and a new set of PAA-Load rules issued shortly after the first of the year. Meanwhile, if you want to put in your two cents worth, get in touch with Mr. George Gardner immediately at Pan American World Airways System, 28-19 Bridge Plaza North, Long Island City 1, New York.

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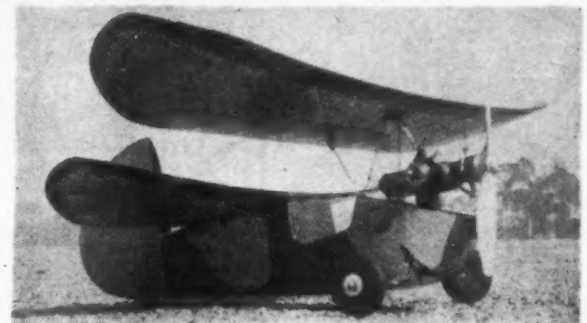
The most important point in building a scale free flight model is to select a design which is as perfectly adapted to this form of operation as possible. One of the best selections we have seen in a long time appears in Picture No. 1, which shows a 22" span model of the French lightplane, the *Bébé Jodel* now being flown by Sherman Gillespie (264 Brooklyn Ave., San Jose 28, Calif.). Sherman states that he was immediately impressed by the poly-dihedral wing and the general clean lines and felt that near-contest performance could be had from this little plane. His intuition was apparently correct as he says that the first copy of this plane, built to his plans by a 14 year old modeler has been clocked at 1 min. 40 sec., and that was only hand wound. The ship is powered with 6 strands of 1/8" flat rubber and weighs 1-1/2 oz. complete.

At first glance the Sopwith *Camel* scale model in Picture No. 2 appears to be a very neat control line job. Closer inspection fails to bring out any control line leads, however, which is entirely natural since this is a free flight job. This little beauty was built by Carlisle Linskie (3222 Maryland St., Dallas, Texas) and the fine photograph was taken by his friend C. L. Kemp (3224 Shorecrest Drive, Dallas 9, Texas). The model has a 47" span and is propelled by a glowplug Bantam 19. Unfortunately, Mr. Linskie did not give us any details of performance of this very realistic model.

A. G. Lennon (11824 O'Brien Blvd., Montreal 9, Quebec, Canada) is responsible for the very successful 1/2A contest model in Picture No. 3. After witnessing the performance of the prototype, many Montreal modelers secured copies of the plans, and the ship has been built by quite a few of them. One such model, scaled up to take a Cub .074, was lost out of sight on its second flight. As originally designed by Mr. Lennon, the ship had a span of 36" and was powered with a (Turn to page 51)



No. 8 Six foot sailplane Jinx held by builder George Paashe



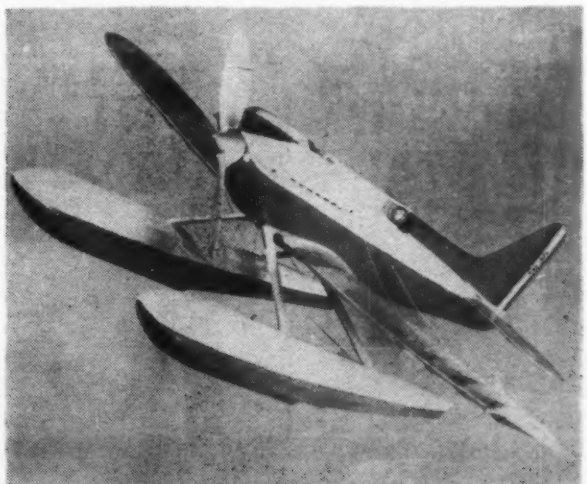
No. 9 Flying Flea gave reader L. Christensen a little trouble



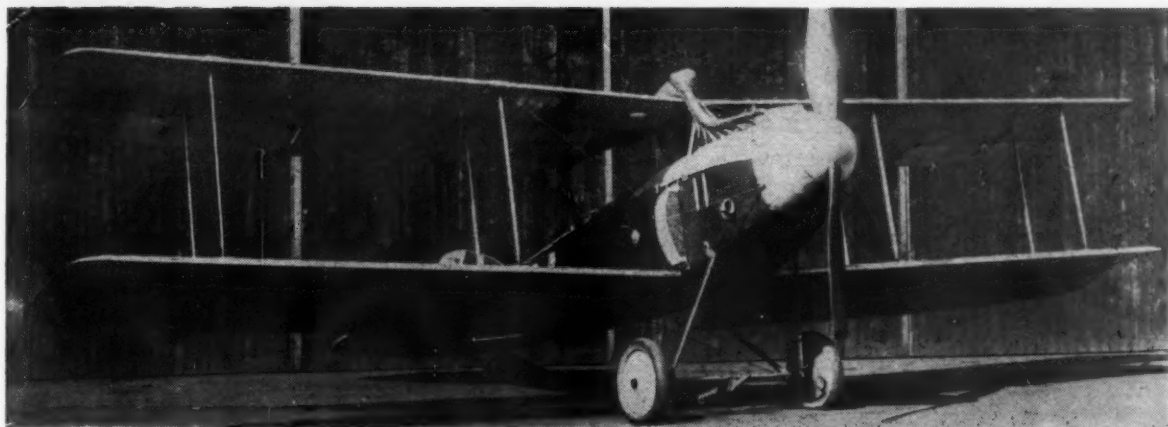
No. 10 A pair of models built in Japan by Lt. Ned Hollingsworth



No. 12 Eugene Adams labored 4 months on this exact scale DC-3



No. 11 Supermarine S.6.B. rubber powered model from P. O'Keefe



Albatros C.V with geared 200 hp Mercedes engine used left-hand propeller. Note equal-span wings and unbalanced ailerons

WORLD WAR I

by ROBERT C. HARE

ALBATROS C.V PART TWO

THIS month we will continue a design and structural description of the Albatros C.V, but first some performance figures should prove interesting.

Although the Albatros C.V was outfitted for a number of duties as the situation demanded, reliable performance figures are available only for the basic airplane, plus fuel, an armament of two machine guns, the crew of two, and full tanks of fuel, oil and water. In such a loaded condition, the basic C.V weighed 3,224 lb. Empty or dry weight—the bare airplane with engine, but minus the “useful load” and military load—was 2,369 lb.

At the above gross weight, the 220 hp model C.V had a top speed of 112 mph at sea level. It could climb to 1000 meters in 4 min.; to 3000 meters in 16 1/2 min. and reached 5000 meters in 49 min. The latter altitude, incidentally, was its ceiling.

With the 260 hp model, however, top speed at sea level was 117 mph, 1000 meters altitude was reached in 3.4 min.; 3000 meters in 12.9 min. and 5000 meters in 29.7 min. Its ceiling was increased to 6500 meters, which was reached in 41.2 min.

The 260 hp model was slightly heavier because the engine was bigger, but no accurate weight figures have been found.

Naturally, when equipment was added and gross weight was increased, performance began to fall off. This occurred not only in itemized performance, but in general handling characteristics. For instance, the C.V, when outfitted as an artillery spotter late in its career, carried both receiving and transmitting radio. Ships so equipped carried a trailing antenna cable with a lead weight on the end, just as was the practice until quite recently.

Two methods were used to reel the antenna in and out. Manual operation was used at first, in which the observer turned a crank on the cable reel. Later, a small clutch was

attached to a power take-off from the airplane engine to do the job. This, of course added weight.

Besides acting as a radio carrier, the C.V in some cases was outfitted with small bombs which were to be dropped when and if a suitable target presented itself. This involved a bomb releasing mechanism, which while very simple by today's standards, nevertheless added weight and drag to the airplane, even more so when loaded with bombs.

So it was not inconceivable for a C.V to go out on a mission with 300 to 400 lb. more weight aboard than the basic airplane carried.

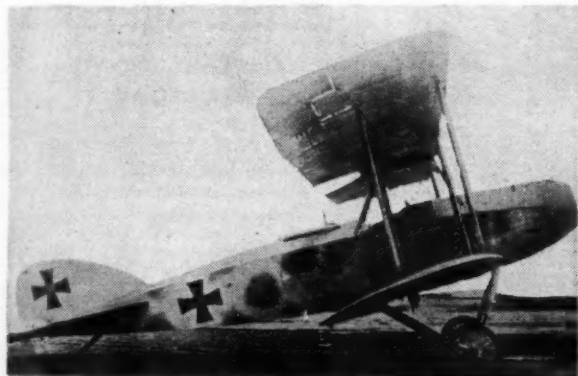
Handling characteristics of the basic type were somewhat below those of Allied airplanes such as the De H-4, Bristol F2B or Breguet 14 A2 of the same period. The Albatros C.V was considered mushy in every direction. Paradoxically, its designers had paid a great deal of attention to streamlining the fuselage and empennage of the machine, yet used a high-drag airfoil designed for low speed efficiency, which effectively cancelled out the streamlining. The result was a “lumber barge” airplane, though very sturdy and reliable.

In flight, the C.V was stable and easy to fly. Unlike many German airplanes, the C.V had plenty of fin and rudder for directional stability, and spinning, for instance, was not inherent—the plane had to be flown into the spin. By comparison, the Rumpler C.IV would spin of its own accord without the slightest provocation.

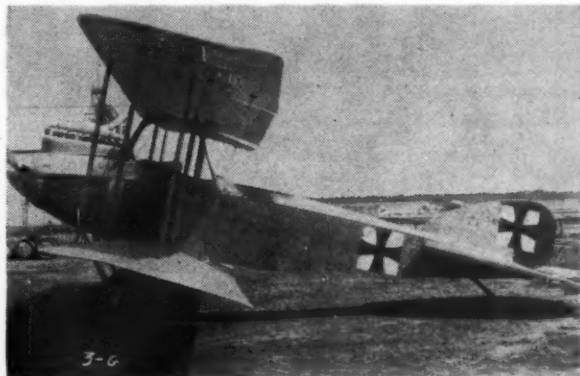
Lateral control of the Albatros C.V was mushy, and there was a noticeable time lag between stick movement and effect. With power on, the C.V stalled very slowly and tended to mush out, but could be held level only with difficulty because of the ineffectiveness of the ailerons.

Longitudinal stability was normal for the period; the C.V tended to be nose heavy with power off, and tail heavy with

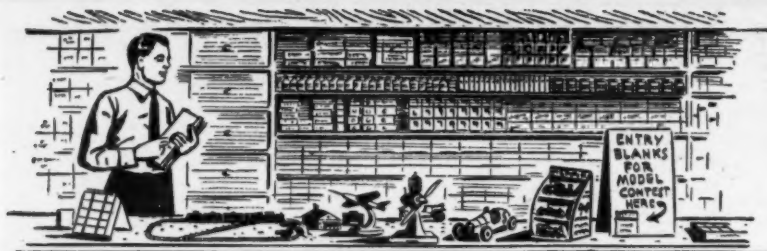
(Turn to page 38)



This sample had balanced aileron, single-post tailskid



Side view of a C.V with 260 hp engine



HOBBY COUNTER

Conducted by THE TRADE OBSERVER

THE trend to small engines is affecting even the .19 category where there are rumors and rumors of rumors about new engines by name manufacturers. To the Arden, Ohlsson, McCoy, Bantam, now is added the .19 Hornet by Victory Tool & Die Co. (3849 Ventura Blvd., Fresno, Calif.). This .19 somewhat resembles Ray Snow's (the Hornet man) famous .80 which, after years of top flight competition, only recently edged over the hill.

With a bore of .656 and a stroke of only .590, the .19 Hornet is a high-speed engine. It weighs 4.5 oz. bare, has glow ignition, of course, and a cast aluminum piston with two rings. The crankshaft is full ball-bearing suspended, tapered for prop-adaptor and fly-wheel mounting. Mounting is four point beam. Recommended fuel is 70% methanol, 30% castor oil, 20% nitromethane (by volume).

"Hell-Razoring" Artie Hasselbach, Consolidated (3087 Third Ave., New York 56, N.Y.), was seen with a radical speed job at recent meet down state New York. Pod-and-boom no less and features both top and bottom fuselage castings. The boom is metal. Big Dooring powered, this ship is fast. When your reporter asked if the novel plane was to be kitted, Artie shrugged, "Could be." With a gleam in his eye.

Ed Pachasa, the Cleveland man (Cleveland Model & Supply Co., Cleveland 2, Ohio) who has been making kits since before most of us were born, who has seen 'em all, from bird-type models to speed jobs, now has the job that tops them all. What could that be? What but a flying saucer. This one is real, whereas those others may or may not be. It works!

Being an old fashioned aerodynamicist, don't ask us how it works. The principle is the flying disc idea, involving a patented "ogee" curve. It does not spin like a pie plate when tossed in the air. Strange thing about the flying disc is that its principle has been successfully demonstrated at least 20 years ago in full scale but modelers passed it by. Cleveland's assembly kits are knocked down, requiring only gluing together, and are printed in blue. There are two kits, each with individual styling in futuristic design detail, fiery rocket tubes, spaceship portholes, etc. They glide, loop, do boomerang returns, all for 39c.

Big news for stunt and free flight fans from Bill Halbert, Flo-Torque (Box 371, Baraboo, Wisc.) who is again manufacturing the Flo-Torque design props. These are available in the following diameters and pitches: 6 x 3, 6 x 5, 7 x 3, 7 x 6, 8 x 4, 8 x 6, 9 x 4, 9 x 6, 10 x 4, 10 x 6. Completely sanded and finished with a smooth tumbled lacquer, the price is 15c. That, friends, is something to chew on, especially in the larger sizes.

Halbert is a real old timer in the prop business, having started in 1939. The new line of props is being turned out at the rate of 7,000 every eight hours in Halbert's new Baraboo plant.

Radio control fans who favor the self-neutralizing type of escapement will be interested in a gem-like but sturdy piece of work turned out by Bonner Specialties (2818 Colorado Ave., Santa Monica, Calif.). According to Howard Bonner, this escapement is being marketed jointly by Bonner and Vernon C. McNabb who developed the license-free MacNabb radio for the Citizen-ship band.

The Bonner escapement operates on as low as 1.9 v. with a fully wound 1/4" rubber drive and weighs 1/2 oz. Rigid and compact. When operating on two pen cells (3 v.) it draws 400-600 ma. Sample unit flight tested by your reporter worked well.

Now gentlemen, here's a super deal, one of those ships the scale fans drool over. It's a 32" SE-5 for \$5.95, by Sterling Models (Philadelphia, Pa.). This U-control scale series by Sterling needs no introduction.

"For years now we have been besieged by modelers who wanted a stunting scale model," Sterling's Ed Manulkin told us, "and, believe me, this is it!" Actually, this SE-5 is not one of the series for it really was engineered for stunting. Sterling isn't saying the SE is just a flying scale job you can stunt if you are good. It is a stunter from the word go, and will do the full AMA stunt pattern with ease. The test ship outflow many flip-flop designs. Vive la bi-plane!

Last month we reported Harold DeBolt's plans (DMCO, Williamsville, N. Y.) for a graduated series of U-control models for definite engines. Now the first has appeared, a cute profile stunt job for .049 to .09 Cubes. Called the All American Trainer, it sells for \$1.75. Kit comes ready for assembly, shaped wing parts, fuselage and tail. Just glue it and fly it. Two, three and four in the series, are the All American Junior stunt trainer for .74's and .09's; the All American Contest stunt for .19 to .29's; and the All American Contest stunt for .29's to .49's. Not only is DeBolt naming engines but he is naming the accessories.

The once Morton M-5, then the Burgess, but now the M-5 by M-S Engineering Co. (Box 192, Libertyville, Ill.) is again in limited production. This remarkable engine, it may be remembered, was a five-cylinder job modeled after the big LeBlond radial engine, complete to working poppet valves. It is, of course, a four-cycle engine. Deliveries are being made on a first come, first served basis, three weeks to one month after receipt of order. Twenty-four-hour service is available for existing M-5 engines, on replacement parts and accessories, tune up, overhauls, bench testing.

America's Hobby Center (New York, Chicago, Frisco, New Orleans, Denver) has issued a new two-color, 64-page, 6 x 9 catalogue describing and illustrating over 200 U-control models and 50 free flight planes. In addition, thousands of model supplies and accessories, balsa, cements, dopes, etc., are catalogued in detail. Articles aid in selecting engines and planes, in

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Run 'em lean, run 'em rich, run 'em ragged. It's Francisco Laboratories (3787 Griffith View Drive & 3015 Glendale Blvd., Los Angeles) that is being run ragged. On a 24-hour-a-day basis, Francisco is able to meet demands for the first time. Francisco, by the way, is also become noted for those wonderful sounding technical names, the latest being siphon filtering. All we know, the stuff smells good when it blows back from a real churning engine. Of course, we modelers don't use all the fuel Francisco cans, for auto and motorcycle racers use it, too, and their tanks are slightly larger. But we do our share!

Ssssh! Got three bucks? Give a listen. America's Hobby Center is cooking with a \$10.00 matched outfit of regularly advertised merchandise, which they are selling for \$5.00. This bargain basement deal includes a Mel Anderson Spitzzy engine. You get a choice of Piper Cub, Stinson Voyager, Cessna or Aeronca Sedan, plus everything needed to build and fly the plane, including control handle and flying lines. No strings attached, they sez. Just wires.

In the Berkeley Models ad, December MAN, the fact that Aerotrol could be used on 27 mc. was mentioned. This ad was placed many months in advance of publication and Berkeley Models requested the magazine to delete the words "license-free". However, the request was received too late by the publisher. The Academy of Model Aeronautics has been conducting tests on the 27 mc. band to determine its desirability for license-free operation. When and if approved by the F.C.C. all existing Aerotrol sets can be easily converted to 27 mc. band. The 27 mc. band is now used license-free in England with much success. Berkeley Models considers the 50-54 mc. band to be ideal for radio control work, and all sets will continue to be manufactured for this frequency until F.C.C. license-free operation is approved for the 27 mc. band.

A new and smaller swivel for model airplane control-line flying is the latest product announced by Sullivan Products (214 W. Dauphin St., Philadelphia, Pa.), manufacturers of Pylon Brand wire and accessories for the hobby field. Despite much lighter weight and their smaller size, Sullivan's new swivels are stated by the manufacturer to be as sturdy as some swivels five times their weight and size. The new, small swivel will take up to three times the pull of the largest Class C airplanes, providing a positive safety factor.

An interesting side light is the method of packaging, a hinged clear plastic book, useful for small parts, etc. Each box contains one dozen swivels, in sizes for Class A, B, C, at 50c the dozen.

Pactra Chemical Co. (524 S. Spring St., Los Angeles 13, Calif.), manufacturers of Aero Gloss Hot Fuel Proof Products, have announced that the 4 oz. Aero Gloss is being packaged in glass, a move calculated to better display the colors for both the modeler's and the dealer's benefit. Pactra purchased in 1950, the Aero Gloss line—Hot Fuel Proof Finish, Plastic Balsa, and 7700 Cement.

Speaking of combo specials, Mercury Model Airplane Co. (920 Utica Avenue, Brooklyn, N.Y.) has a couple of lulu's. One, for \$7.75 gets you a choice of a number of popular kits with a baby engine of your selection, plus an accessories kit. Then, with choice of O & R 19 or 23, or McCoy 19, there's a \$12 deal with some top B and C jobs. Mercury has specialized in combos from way back, and has a couple of other variations.

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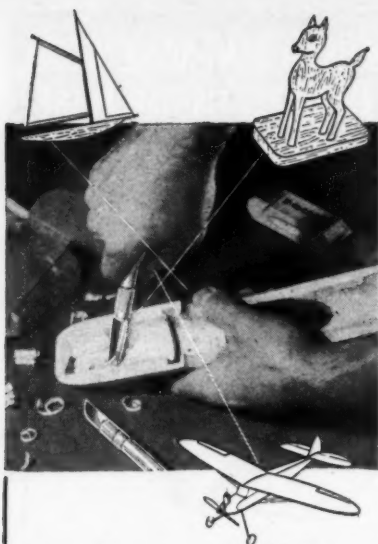
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Scrap Box

(Continued from page 2)

that the ship flew too slowly for this airfoil to do a job. Since the writer has success with it on 138 sq. in., it seemed evident that many factors make a farce of the airfoil arguments. First, wing loading. If wing loading goes up, the ship glides faster. Everything else equal, the ship requires one airfoil for the faster gliding speed, another for a slower gliding speed. You can see this in present trends in gas to thin, flat-bottomed stuff with large areas. This brings up the charming concept that you can develop only one best airfoil for one particular ship and that even a change in weight means that some other wing section might be better. In three classes, the same basic design would employ three different sections—if you go in for legit sections. This is the real reason why successful Class C models often prove stinkers in Class A. On the other hand, the 4612 has proved ideal with high wing loadings and has met with outstanding success in many nations for Wakefield jobs. One thing is for sure: on lightly-loaded free flights the modeler's zip-zip flat-bottom sections do the job. Reminds you of what Frank Ehling once said, "There is no science in model building."

If you live to be 100 you'll still never learn all the answers, even without the science. Just learned some bitter lessons in R.C., and lost a ship in the learning; this during windy-weather tests for control response. The story behind this particular airplane was that the fuselage was a long one with about a 50% moment arm. The object was to achieve a wider turning radius and the fuselage was one of the factors involved. Now, the weight of tail, on the end of such a long fuselage, required weight well forward of the C.G. to achieve the proper balance.

Stall oscillations developed and, in a turn, the plane was so sluggish on recovery that the point of exit had to be anticipated by about 45°. In a wind, you'd have to be Houdini. The trouble traced quickly to the disposition of weights so far from the C.G. and the effect of inertia on the flight. So the fuselage was hacked in twain, shortened, and the weight pulled back out of the nose. And then we finally savvied this business of forward trim, that is between 35 and 40% of the chord. To make it work you usually need some negative in the stab. But why must a R.C. job be so trimmed, we kept asking.

You know how you trim a yo-yo well forward, usually between the pivot and the front line, maybe on the front line? And, when you move that balance point to the rear, how sensitivity builds up like mad? That's the same deal, don't you think? Until now, our R.C. jobs have been trimmed well back, more like free flight. While these jobs made many successful flights there always was a danger or a tendency, however slight, to hang in a wind, like a free flight ship. And that you don't want. This brings up another interesting factor. Low pitch props help the ship to hang, whereas high pitches cannot. Smaller diameter and higher pitch hold possibilities.

Bill Bailey, Walla Walla, Washington, wants in on the fuse dethermalizer fight. "Fire hazard must be banned," said June Dyer some months back. "Not if they are made right," answered a California club. Now hear Bill Bailey's argument.

"I have been an active free flight modeler for the past 16 years," says Bill, "and am worried about the fuse dethermalizer problem. Lots of us, including myself, have been using the old fuse as a light and fairly dependable way to get down that old clunk."

"We have nothing but miles of stubble fields around here and I know that fellows in other parts of the country fly from the same type of dry fields. My C-job dethermalized two weeks ago and it was lucky that I was only a few feet behind it because the fuse had started a fire that I was able to stamp out. It's happened to other fellows I know, and I hate to think of what could have happened if we hadn't been on

the spot. If you could warn other fellows about the dangers of the fuse, it would be a useful service to modelers throughout the USA. As for me, I'm changing to something else." What do you think? While safe fuse dethermalizers might be built, it would seem impractical to expect that all modelers could be depended upon to make them. It has been proved a number of times that fuse dethermalizers are causing fires and it is nothing more than common sense to inconvenience ourselves a bit and outlaw the fuse. By the way, when will someone develop a dependable timer for long durations?

Delbert Harbold, Wichita, is a man of ideas. Before turning him loose, we should explain that remarks about speed a couple of columns ago made him stew up a storm. Let her rip, Del.

"I would like to expand my U-control stable to include speed," says the gentlemen from Kansas, "but what is the sense of it? They build a 19 job, carve a 60 down to 19 size and grease it to force it into a 19 cowl. But to me the payoff is the landing, with the ship slithering in like a lizard. I agree that the engine should not be butchered externally, except for trimming of a stack to get a one piece cowl in place, but said trimming not to include the rear side of the stack."

"My suggestion," goes on Harbold, "is to correct these deficiencies by adding a landing gear. The model should land on the same wheels from which it took off. Penalty of a nose-over to be a disqualified flight. To lift its weight this model would have to have decent wing area and enough weight at the extremity to oppose flipping-over in landing. How about making them look like something, say with a minimum cockpit height? In other words, team speed, without the team."

Harbold, you fascinate us. Glad you added that bit on teamless team racers. The appeal of such a ship to the average modeler is very great. Could be that events for such airplanes, run like any speed event, would not only save speed but boost it beyond the dreams of the stubborn die-hards who would keep it for the few, like they did in indoor. (Throw out the microfilm, we sez, so a guy with the shakes can make one!) But do go on, Senor Harbold.

"On free flight," Del picks up again. "there should be two classes in age. One, up to 18, who have time and no money; and the other 18 to 108 (about covers it don't you think?), who have some money but no time. Also throw out all stick and AMA cabin; replace with the Wakefield and a trainer Wakefield (140 sq. in.). And why not regroup gas in two classes: up to .20, from .20 to .65. There are so many events that prizes, building and flying efforts are spread out too thin." You don't annoy us Harbold. We even want to stick an .049 in a Wakefield! Let's make it popular and cut out the private club atmosphere.

"You want to know how to popularize speed," DeBolt reminds us. "The best thing that could be done would be for the magazines to co-operate with it, instead of treating it as something that has to be tolerated and digging it every chance they get." Lookit those flags waving!

"It would seem better not to say anything, rather than say something that would hurt any phase of the model sport," Pappy goes on. "We do not need to do a great deal to keep the thing rolling. Just as many fellows are flying speed as ever. I do think that the older fliers should lend what support they can to beginners so that they will not find reason to become discouraged."

"In our club we lost 50% of the speed fliers—the Army, girls, and hot rods. All pretty good men; it will be tough replacing them, but we are accomplishing things slowly. First, we help beginners all we can in flying their models and getting to contests, though they still must do their own work. We give the fellows under 21 a 5 ml. handicap. The Open boys don't like this as the younger fellows beat them too often! The big item that helps is running contests. These give something to work for and provide the initiative neces-

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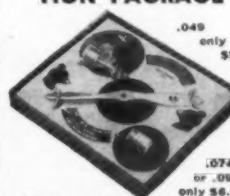
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sary for progress.

"We find that the two-bit type of contest works very well and keeps everybody happy. We have just run our fourth full scale meet this year and had 45 entries at the record trials with 100 models entered."

With all this talk about yo-yo, how about a story to go with it? Okay. Curtain! Music! The scene is sunny California, the state which borders Brooklyn at the Mississippi. A big, heavy stunter thunders around, its Orwick roaring, and flier Lou Nordlinger on the other end of the 70' lines. Suddenly, ping! So there is Lou holding the handle, with the model doing loops way off in the distance. The Orwick finally quits and the post mortems begin. Seems that the up-line broke at the handle and the down-line at the airplane. The lines then curled up, as music wire does when the tension is released, and the two coils of wire, whipping past each other, smagged—leaving Lou with one line about 130 feet long.

This Wagner deserves a subscription by now, what with all the entertainment he's given us, and this story clinches it. Take away the prize for the best tall-but-true story of the month, Joe Wagner.

Report From the West

(Continued from page 8)

42.63 mph. The 1/2A Proto ships are becoming very popular, and it is noted that the speeds are beginning to climb very rapidly. Herm is one of the northern "wheels" and is very nearly always in the winner's circle. This competent lad is one of the "spark plugs" of that sharp Alameda Aero Modelers Club.

A rather unusual type of challenge meet is coming up, and we shall be looking forward to witnessing this event. A team of five rubber modelers will attempt to down a competing team of five gas modelers. The rubber team will probably consist of Ernie Wrisley, Dick Everett, Fudo Takagi, Red Everitt and Harvey Patten. These men will have their hands full flying against the following probable line-up: Ed Rominger, Denny Davis, Nat Antionelli, Jim Thompson and Tommy Moffitt. We have seen all of these flyers in action, and they are all "ones to beat" at any contest they enter. We'll give you all of the facts and results of this contest at the earliest possible date. They should be very interesting. Don't sell the rubber boys "short."

We rolled up to Camp Hahn the other day to take in the Long Beach Thunderbugs free-flight contest. The Hahn site is wide open with slightly rolling hills. The day was quite warm and the haze was much in evidence. It was rather surprising that the thermals were so few and far between. Along about ten-thirty in the morning the wind came up and short O.O.S. flights were frequent. A contestant was allowed only one ship and could pick any class he wished for open and junior competition. Cash prizes went to the winners and the size of the purse was governed by the number of contestants in each of the two classes. One of the most amazing flights (in testing) was made by Don Moorehouse. Don has one of those famous Super Buccaneers weighing 5 3/4 lbs., and carrying an Ohlsson 60 for power. We were surprised by the excellent climb, but it was the terrific glide that really had our eyes popping. Seven, eight, and ten minute flights are not unusual for the huge model. We might add that this plane took a third at the recent Bakersfield contest.

Russ Johnson of San Gabriel, California, gave us a look and run-down on some of the pertinent facts about his little original 1/2A ship, the *Muha*. This ship carries a 177 sq. in. wing and incorporates a 50% stabilizer. It carries the very popular Wasp .049 engine. Russ and Gene Wallock, both Thermal Thumbers, are collaborating on two larger *Muhas* for B-C competition. These newer ships will carry out the theme of the smaller model. F. L. Swaney directed the contest. Top winners: Open, Jack Oxley, Jr., Paul Strehlow.

We had a chat with J. C. "Madman" Yates the other day and eventually the talk got around to U-control stunting. Several other modelers got into the discussion, and all hands agreed on one definite factor. In our minds, precision flying should really be *precision flying*. By this we mean that the large round maneuvers that almost every flyer of any ability at all can easily execute should be a thing of the past. We are all in favor of flying under an altitude of 6' in the straightaway flying, and also in favor of cutting the maneuvers down to the smallest possible area of flight. We don't mean a jerky and unproportioned flight but a small clean-cut pattern. In a pattern that is held 6' and over, mostly over, it is very hard for a judge to make his decision on altitude infractions. Flights under this height could be more easily judged. We have seen many meets and the altitude that was held during the inverted laps as well as the level flight were seldom under the 8' or 10' marker, yet no points were deducted. Figure eights, both horizontal and vertical, more often than not miss the correct height. Undoubtedly the big "scream" of unsafe flying will pop up. In our opinion, this is usually elaborated upon too much. Don't mistake our meaning—we are very much in favor of strict safety rules, but can't see how low flying would be dangerous if the contestants and spectators are kept back as they should be. This type of flying is now being done at some meets and bonus points are given to the contestants flying below the 6 foot marker and for cutting down the size of maneuvers. Did someone say something about scale proportions? This thought was for precision stunt jobs, not scale models. We shall elaborate more on the stunt pattern discussions that are taking place "out West" in future columns. If any of you stunt men have ideas about the stunt pattern, etc., drop us a line so we may get several other points of view on the subject.

You model jet pilots had better look to your laurels as there is a very nice looking young lady who has been burning up the air with her original *Dynajet* powered speed job. The name is Mrs. Violet Hoyt, wife of Navy Lieutenant M. J. Hoyt. Violet has made several flights of well over 125 mph. All classes of speed flying are taken in stride by this young lady, so don't say we didn't warn you.

We checked a few of Wally Short's flights the other Sunday and they were tops. Wally had his new A.W.O.L. *Mac* 19, 23 1/2 oz. job out, and the screaming climbs were terrific. Wally is a member of the San Bernardino Flying Wheels and has given many of the flyers at the Plymouth Internationals and other meets gray hair with his hot ships. His trophy collection is rapidly growing.

The Team Racing "Stalwarts" are rounding out wonderful contest programs and are giving the information to the modelers in a very unique style. A well designed poster with a standing back, for counter display, has photographs of ten flyers in action and also carries a picture of a beautiful racing job. Along with these two items, several mimeographed sheets are attached with information about the events that are to take place. Six big events are scheduled for December 10th, as follows: beauty event, 7 lap heat races, 21 lap heat races, 1 mile trophy dash for the 3 fastest qualifying models of the day, 5 mile semi-main event for 4 models winning points in the heat races, and the big 10 mile feature race for the 4 models with the most points in the heat races. These contests are open to all model builders. A.M.A. Team Racing rules will be followed. Processing of all races will start at 10:00 a.m. and the first races will commence at noon. The Santa Anita Parking lot in Arcadia will be the location for the December meet. We'll be on the lookout for Keith Storey's new ship.

Charlie Goodale, Naval Training Hobby Shop instructor, has a new brain child on the board. Just for the novelty of it, Goodale is designing a flying fuel tank and will

see how much time he can make on a non-stop flight. From here it looks like he is going to need a couple of strong arm co-pilots to help out on this little venture. We'll give you modelers a look at this "flying tank" as soon as it is ready for the long hop and will give you the time, type of engine used, fuel data, and all other information pertinent to the big experiment. This should be very interesting, as many factors will have to be overcome before the ship ever takes to the air. Balance and good fuel induction will probably be two major "gremlins" to combat. Anyone need an engine broken in?

Torpedo .049

(Continued from page 27)

erances. Use recommended fuels, and filter the fuel occasionally to make sure it is clean. When the engine is not being run, keep it covered with a soft rag wrapped around it. A good stunt when flying from a dirt field is to carry a large piece of cardboard to place under the model when running the engine. After completing a day's flying, always clean the engine thoroughly with denatured alcohol and put a drop or two of oil into the intake and exhaust before putting it away.

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Polar Star

(Continued from page 19)

skis at the angle shown. These skis can be painted silver if desired. The hooks in the wheel pants are drawn oversized. Make these as small as possible. Note that rubber bands are also used to hold the bottom section of the pants in place. The dowel insures alignment.

In case you intend to use an engine that cannot be radially mounted, dural stamped beam mounting brackets or cast magnesium brackets are available at your hobby shop. These are screwed to the bulkhead and the engine can be beam-mounted to these brackets. They work swell.

Make sure the model balances at the point indicated. Add lead weight to balance the model correctly. If you fly from grass, it is suggested that you fly without the bottom half of the pants so the model will not snag in the grass. Steel lines of 45' lengths are used. When flying from snow, try to select an area of freshly fallen snow without foot prints. At any rate on wheels or skis the *Polar Star* will please the most discriminating model builder.

News of Modelers

PEN-PAL SEEKERS: John Goodwin, 17 Leigh Street, West End, Touensville, Queensland, Australia is interested in control line stunt and team racing and would like to correspond with someone who has similar interests . . . Roger Howe, Sidcot School, Near Winscombe, Somerset, England would like to correspond with someone around 14 years old who shares his interests in scale gas jobs. U-control or free flight. He would also like to exchange English magazines for ours.

EXCHANGE MOTORS: E. A. Johnson, 38 Bull Lane, Orrell Park, Liverpool 9, England has a brand new *Elfin 2.49* cc. stunt engine which he bought for the express purpose of exchanging it for an *Arden .199* . . . Arthur W. Wilson, Box 211, Warrenton, Missouri would like to exchange his *Supertigre .36* in. diesel for a *McCoy 60* or other large engine of reputable make.

SPECIAL REQUESTS: Rene Charette, A. S., Aviation Consultant, 213 Besserer Street, Ottawa, Ontario, Canada will answer any question that he can pertaining to Aviation in general, and Aircraft in particular. M.A.N. readers may ask as many questions as they wish.

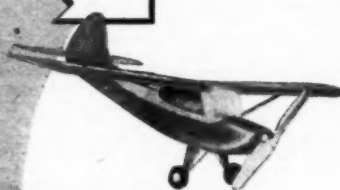
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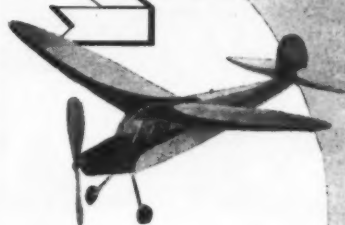
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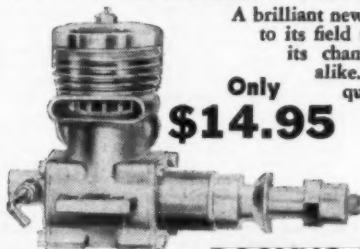
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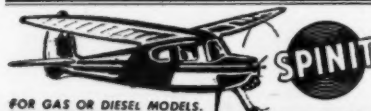
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Radio Control Planes

(Continued from page 11)

since it takes no power to hold a desired control position. Control confusion is a relatively minor point when you utilize Bill Winter's "discovery" that if you are in a turn and become confused, one pulse will always bring you back to neutral regardless of the turn direction. Four-point escapements have the advantage of more positions to utilize for added controls, as Rudervator utilizes them for throttle and cut-off.

Since most escapements will run about 1 oz., we can use this figure for servo weight.

Finally the greatest source of unsuspected weight gain in the control system is the wiring job. Switches are the easiest dead weight gatherer of this section. An ordinary toggle switch, double-pole, single throw, will weigh .65 oz. Slide switches will weigh considerably less, but experience has taught us to look with suspicion on this type as they are prone to be unreliable and subject to vibration. This would appear to leave little choice; however, it is possible to make switches that are still lighter and yet have all the reliability of the toggle switch. This type is shown in the drawing and consists of simple dress snaps, a little scrap of brass and some plywood. They will run about .1 oz. per switch, which means a little over 1/2 oz. saved, almost 3% of the total weight of the 33 ship!

The best hook-up wire found to date is Belden No. 8014 indoor antenna wire. It comes in 25' hanks and is easily procured at your local radio store. Wire enough for the average small ship will run about .07 oz. Next, for light weight the 10,000 Ohm potentiometer of Control Research is first choice. (If it will not handle the load when using a 60-v. "B", a small 1/2 w. fixed resistor can be added in series.) Weight for this unit is .08 oz.

A phono jack is the standard component for meter test plug and will weigh .14 oz., although a little weight can be cut off by reducing the size of the base.

To tie all these components to the electric supply, we use the handy dress snaps on the batteries. They are light and positive, and make battery replacement simple. Polarity is easily maintained by using the male snap on all positive terminals.

The only remaining part of the wiring system is a miniature five-prong connector that hooks the receiver to the wiring at a weight of .25 oz. This, of course, can be eliminated by wiring the receiver direct to the batteries, but the convenience of easy receiver removal more than offsets the weight of this part except for special purposes when such weight is a premium.

The total wiring will run between .39 and .94 oz.

We now have all the components and their weights that make up the payload the ship will have to carry. Simple addition will soon reveal that we have an absolute minimum of 7.29 oz., and a maximum of 10.84 oz. with several possible combinations in between. This is certainly no load for the remarkable small powerplants we have available today. Experience has shown that a 4' ship of more than adequate strength will run about 28 or 30 oz., and anyone knows that an .09 engine will haul that weight with a considerable margin of power to spare. The author feels that this tendency toward overpowering is handy as it allows a comfortable amount of liberty with prop selection and power output. It is a lot easier to cut down the power than try to get power that is not available. Perhaps, Jim Walker's "slow motion" prop would give a simple adjustment for this problem.

As for actual ship design, that is a story that could fill a book; however, I have included a few examples as a cross section of work done in this new class. The ship shown in the drawings and in picture 1 is a fairly good example of what I consider about the upper limits of the "Midget R.C." class. Construction is very simple and flying performance leaves little to be desired for beginner or expert.

Next in line (Picture 2) is the 42 which

is the original of the small ship line built by yours truly. It is powered by a Cub .074 at present, although it has been flown with both a Mills diesel and a Cub .09. Weight is 24 oz., and as you might have guessed, the span is 42". The .074 is an ideal power plant for this weight; it gives that reserve of power that becomes so useful when everything is not up to snuff, yet does not climb you into trouble too fast. The design itself is victim of too great a rolling moment due to the polyhedral, and consequently has a wicked right turn entry. However, as a workhorse and balsa bulldozer, it has proven many tricks of simple construction useful in the midget field.

At the smallest end of the class (Picture 3) is the little 33. As a midwing it was an experiment to see if fixed wing construction was practical in this small size and to get away from the usual cabin design. The structure was unable to take the rough and tumble of the relatively poor fields available in our area, so I bowed to convention and converted it to the standard high wing setup in Picture 4. With a span of 33" and a weight of 13 1/2 oz. dripping wet (considerably smaller and yet not much heavier than some Wakefields), it is probably one of the smallest and lightest outdoor R. C. jobs in the country today. It packs the minimum receiver weight, which at 7.29 oz. is almost 54% of the entire weight of the ship—a respectable payload in any airplane. Power is the well-known Baby Spitfire. The escapement in this ship is a special four-point design that gives useful one-half rudder positions of less than one-third the full movement instead of three-fourths plus movement, as in the standard type. This means the ship has two definitely different size circles in both directions. This escapement has proven a useful and interesting addition to the rudder-control field.

The other two ships shown in the photos, while above the 48" limit, are interesting because of their small wing area and small powerplants, compared to run of the mill ships.

John Worth designed the ship shown in Picture 5. It has a 300 sq. in. wing area and a total weight of 24 oz. The entire upper half of the fuselage is removable for easy receiver maintenance. The plane also sports a separated receiver-relay mount that is claimed to give better radio protection. The ship suffers as does the 42 from rocking caused by the poly, although it stabilizes out quite well when the turn is developed. An Arden .09 naturally overpowers the ship at this weight, and John reports that they resort to putting the prop on backwards to kill the climb!

Last but not least we have Bill Butler's Floater Bug. This ship utilizes the well-known Jasco Floater wing, stabilizer and rudder, with a Rudderbug-type fuselage. Powered by an Arden .09 it weighs 34 oz. and still has that extra performance under power that I like to see. This ship is the exception that proves the rule as far as polyhedral is concerned; it is well known in the Los Angeles area for its consistent performance, and it probably has more flights logged on it than any other R. C. ship on the West Coast.

Well, there you have a cross section of radio control in the Midget class as seen on the Coast. Practical, simple, and inexpensive, the sky's the limit on design, and a new horizon opens up in the model field. The rest is up to you.

World War I

(Continued from page 31)

power on. Tail heaviness diminished above 3000 meters, and to its ceiling, the C.V. was nicely balanced.

Directional stability of the airplane was very good. With the 220 hp geared powerplant, the C.V. tended to turn to the right because of the clockwise rotation of the propeller, when viewed from the front. The 260 hp direct drive engine model had a definite tendency to turn left.

On take-off, the C.V. gathered speed slowly and became air-borne after a short

run. The ship would take off with its tail low, and climb slowly at a shallow angle of attack. Landings were easily accomplished. The C.V. approached best with power on, and lost speed rapidly once the throttle was chopped and the flare-out was made. The already short ground roll could be made still shorter by using the claw brake fastened to the axle.

Although there was much to be desired in the Albatros C.V as a combat airplane, it was stressed for and could perform all standard combat maneuvers at medium altitudes. To fly a C.V in combat was a tiring experience. But as a steady, reliable platform from which to take photos or spot ground activities, the C.V. was as "tame" an airplane as was developed during World War I.

WING CONSTRUCTION

The variations of the Albatros C.V wing form were discussed in part 1 of this article. The upper wing in each case was basically the same; slight variations in aileron detail and outer interplane strut placement were made. In each case the upper wing was made in two sections—right and left—joined to a steel strut cluster above the fuselage. There was no center section as such. The basic airplane upper wing, from which any deviations in other arrangements will be noted, carried the engine radiator. This member actually was attached to the strut cluster, but each upper wing panel was mortised at the root to fit around it.

Typical Albatros wing construction was followed. The front spar was located very close to the leading edge with the rear spar approximately at the center of the chord. 14-1/4" aft of the rear spar a false spar was provided. Towards the wingtip it served as the hinging member for the ailerons. Trailing edge was wire, and the leading edge was cut out of a solid wood beam to the shape of the airfoil entering edge.

Both main spars were made of spruce and were box type. Each spar consisted of two halves routed out and glued together and firmly joined with a hardwood tongue through both flanges. The rear spar was somewhat larger than the front, presumably to bear the load imposed on it as the center of pressure moved back at high angles of attack.

Wing ribs were made up of three-ply spruce flanges with ash capstrips. Every other rib was a false rib carried back to the rear spar in order to preserve the airfoil.

Six steel compression tubes were arranged at various stations between the main spars in each wing panel. They were attached to steel fittings which also served to anchor crossed steel bracing wires in each compression bay.

Ailerons in the Albatros C.V were framed entirely in steel tubing welded together in jigs. Several aileron planforms were used on the airplane, however. Most commonly used was a member which was aerodynamically balanced and diminished in chord towards its tip. The balancing area was near the tip but several inches within the tip outline, was rectangular and extended ahead of the hinge line. A second aileron configuration was one in which the chord was wider at the tip than at the inner end. This planform was employed both with and without an aerodynamic balance. A third type was unbalanced and of constant chord. In each case the aileron trailing edge was washed out to improve tip stall characteristics and effectiveness at low speeds.

A few models of the Albatros C.V were constructed with a lower wing equal in span to the upper, but these were rare. The basic C.V lower wing platform carried an "elyptical" tip. In other models the lower wing tip was raked at the same angle as the upper wing. Lower wing structure, in either case followed the practice described for the upper wing.

In all versions, the lower wing carried the aileron control wires internally. Their course was changed from spanwise to vertical at the outer interplane struts, and the ends were attached to a chord-line



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control arm. Clips placed along this arm at intervals permitted an adjustment of aileron travel limit to suit the pilot, the type of lateral response desired, or the particular condition of the airplane. Sheet aluminum access doors were provided in the lower wing surface to permit inspection and lubrication of the pulleys.

In the equal span model C.V., which is illustrated with this article, the outer interplane struts were located on the fourth rib from the wingtip, counting the tip as a rib. On the basic unequal span model, these struts were located at the fifth rib.

Interplane struts were made of streamlined steel tubing attached by standard German ball and socket fittings. They were crossbraced with steel cable in the plane of the struts, and conventional lift and drag bracing was used spanwise. Additional drag bracing ran from the upper inboard strut fittings to the front landing gear-fuselage fittings, and from the lower front inboard strut terminus to a fitting at the foremost nose bulkhead.

Following is a table of principal dimensions taken from a captured Albatros C.V., except for those figures starred, which are from a German source:

General Dimensions, Albatros C.V			
Length overall.....	30' 0"	8945 mm*	
Wing Span, upper.....	42' 0"	12780 mm*	
Wing Span, lower.....	40' 6"	12440 mm*	
Chord, upper, lower.....	6' 0"		
Span, elevator.....	10' 0"	3050 mm*	
Wheel tread.....	6' 5 1/2"	1950 mm*	
Gap.....	6' 0"		
Dihedral, both wings.....	2 deg.	2 deg.*	
Wing area.....	440 sq. ft.		
Engines, Mercedes D IV 220 hp at 1400 rpm			
—propeller geared down to 910 rpm;			
Mercedes D IVa 260 hp at 1436 rpm direct drive.			

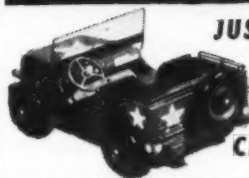
In its day, the Albatross C.V was a mainstay of German reconnaissance squadrons. But as advanced as it was for its time, it was soon superseded by better ships and was relegated to training fields.

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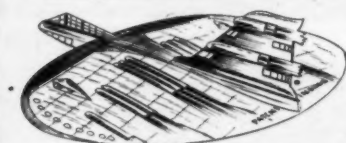
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Flash

(Continued from page 7)

THE TRANSITION from helicopter mail to helicopter passengers will be under way shortly and the first tangible step has been taken by Los Angeles Airways, famed helicopter mail operator, which has ordered the first Sikorsky S-55 ten-passenger helicopter. Delivery is expected early next year for preliminary tests and familiarization of flight and ground personnel. The Civil Aeronautics Board has not yet approved helicopter passenger flights on schedule.

FIRST JET AIRLINER to be operated in the United States may be the Avro Jetliner on National Airlines. Airline President George T. Baker reveals that he has been negotiating with Avro Canada for several weeks and that the only remaining problem is the question of delivery dates. First jet airliner in America will probably be the DeHavilland Comet, however, which has been ordered by Canadian Pacific Air Lines for use on its trans-Pacific routes.

INTENSE DISCUSSION of jet airliners over the past two years by U.S. engineers and airline executives may be only interesting conversation, however, because the airlines continue to pile up orders for those good, old-fashioned piston engined transports. Douglas Aircraft reveals that it now has orders for 91 DC-6 airliners on its books (after delivering about 150), of which 68 were received in the past month. Purchasers include Pan American Airways (18), American Airlines (11), United Air Lines (6), Swissair (2) and various foreign purchasers, all for the DC-6B super version.

U.S. PILOTS are getting plenty "stall-wise" and more than 10,000 U.S. personal aircraft are now equipped with the Safe Flight Indicator (more popularly known as the stall-warning indicator). The device uses a simple vane on the wing leading edge, which lights a warning light on the instrument panel in the simple version or shakes the stick violently in the expensive version. Virtually all new Navy jet aircraft are being equipped with the device. Just to show you how far the device has come in its short life, the Douglas Super DC-3 certificate includes the stall warning indicator as required equipment!

TOP USAF COMMAND continues to swirl and boil as the top-level generals maneuver for the post of Chief of Staff when General Hoyt S. Vandenberg retires in 1952. Long believed slated for the top post is Lieut.-Gen. Lauris Norstad, who, at 44, is the USAF's youngest officer to attain that rank. Norstad was originally tabbed for the Alaskan command but has now been named Commander in Chief of the USAF in Europe. This is the operational command that Norstad has lacked, having spent most of his career in staff duties. Lieut.-Gen. Nathan F. Twining has been promoted to full General and named Vice Chief of Staff. Lieut.-Gen. Idwal H. Edwards has been confirmed as Deputy Chief of Staff for Operations.

YET ANOTHER "Delta-wing" airplane, so-called because its triangular planform resembles the Greek letter delta, has made its appearance. The Boulton Paul P 111 was being readied for the SBAC show last September but could not be prepared in time. It has now flown and its 5000 lb. thrust Rolls-Royce Nene turbojet engine gives it a top speed in the transonic zone. It has 45 deg. sweepback along its leading edge and a large vertical fin. Air intake is in the nose. Like the Avro 707B, a tail parachute is used to slow down its high landing speed. Both British types are research aircraft only, to obtain the data needed for the design of large Delta-wing jet bombers which are rumored to be nearing flight test stage in England. The Convair XF-92A is the only U.S. Delta-wing airplane to fly, and the type has exhibited several adverse characteristics which may shorten its future to experiments only.

NEXT GREAT BRITISH jet fighter will apparently be the sleek, swept-wing Hawk-

er P.1081, which is not only going into quantity production in England but in Australia as well. Although the prototype is powered by a 5000 lb. Rolls-Royce Nene turbojet, the production model will have the 6500 lb. thrust Tay, which should bring its top speed to sonic. Like all British fighters, the P.1081 is extremely small with a span of only 31½', about the same as a Piper Cub.

ONE OF THE truly advanced aircraft now available is the new Beech Twin Bonanza, which has accommodations for six persons and is powered by two Lycoming GO-435-C2 engines of 260 hp ea. The trim little ship, unlike its namesake, uses a conventional vertical tail and features fully retractable tricycle landing gear. It has a useful load of more than 5000 lb. but cruises at 190 mph and lands at 60 mph. It can fly for about 1,000 miles and can climb to 20,000'. Beech is currently concentrating on sale of the sleek twin to the armed forces as a trainer, photo plane, aerial ambulance or light cargo plane after which it will be made available for commercial sales. However, its price is expected to be in the neighborhood of \$35,000 which, while seemingly high for the private owner, is just one-half that of the Twin Beech it replaces.

MODEL AIRPLANES may have an active combat role if current Army experiments prove successful. Using radio-controlled models similar to the target drones for gunnery practice in World War II, the Army is perfecting a method of laying half-mile-long sections of light-weight telephone wire. The drone, with one end of the wire attached, takes off from a catapult and unreels wire from a canvas container, which stays behind on the ground. When all the wire in the container has been towed aloft, the operator simply shuts off the engine of the model by radio control and the drone parachutes to the ground with the wire still attached. The wires in separate containers can be joined in a single flight when the distance to be covered is greater than one-half mile but the weight of the wire has a maximum determined by the power and lift of the drone.

IT IS GROWING progressively more difficult to follow the tortuous twists and turns of the Civil Aeronautics Board. Their latest bit of illogic is an order to all airlines offering "air coach" service, one of the biggest things to hit civil aviation in this country in all its history, that they must raise their fares from the present 4¢ per mile to 4½¢ per mile! Air coach service, as you know, is flying without frills but at rates not only competitive with but actually cheaper than railroads on trips of more than 2-300 miles. Response to the low fares has revolutionized the thinking of every airline executive in the nation—yet the CAB has now decided in its wisdom to raise these fares. It does not take an economist to predict that the fare raise will simply slash off an equivalent amount of business. In addition, the Board ruled that air coach service must continue to operate only at off-peak hours (i.e., late at night), withhold meals and other extras, etc. And the existing services are authorized only until March of next year, when another CAB "study" will have been completed. Let us hope that Del Rentzel, the new Board Chairman, will be able to bring order out of the historic chaos he is inheriting.

DESPITE THE historic success of the first non-stop trans-Atlantic flight of a jet aircraft (Col. Dave Schilling in a Republic F-84E Thunderjet using in-flight refueling), it is interesting to compare its performance with the antiquated piston-engined airliner. The Thunderjet made the 3300 mile crossing in 10 hr. 1 min., or at an average speed of 330 mph. It is a little startling to compare this speed with the recent accomplishment of a Boeing Stratocruiser, which covered the 3565 miles between New York and London in 9 hr. and 16 min., for an average speed of 386 mph! If the standard prevailing westerly wind of 20 mph is assumed, the average speed of the Stratocruiser works out to 366 mph, while that of the Thunderjet is increased to only 350 mph. So don't let the jets fool you

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1/16x1/8	1/4	1/4 sq.	3/8	1/32x2	80
1/16x1/8	1/4	1/4x1/2	60	1/20x2	80
1/16x1/4	2	1/4x3/8	70	1/16x2	80
1/16x3/8	2 1/2	1/4x3/4	80	3/32x2	100
1/16x1/2	3	1/2 sq.	80	5/32x2	120
3/32 sq.	1 1/2	3/8 sq.	50	1/8x2	120
3/32x3/16	2 1/2	3/8x1/2	80	3/16x2	140
3/32x1/4	2 1/2	1/2 sq.	80	1/4x2	160
3/32x3/8	3 1/2	1/2 sq.	80	5/16x2	180
3/32x1/2	3 1/2	3/4 sq.	150	3/8x2	200
1/8 sq. 3 for 5c	3 1/2				
1/8x1/4	2 1/2	1 1/2	1/2x2	220	
1/8x3/8	3 1/2	1 1/2	1/32x3	130	
1/8x1/2	4	2x2	1/16x3	130	
5/32 sq.	1 1/2	2x4	1/25	3/32x3	160
3/16 sq.	2	3x3	1/8x3	160	
3/16x1/4	3	3x6	3/16x3	220	
3/16x3/8	3 1/2	4x4	1/4x3	250	
3/16x1/2	3 1/2	4x4	3/8x3	310	
		4x5	1/2x3	340	

Propeller Blocks				18x1-3/4x2 32c	
8x7/8x1-3/16 .6c	1-3/4	24c			
10x1x1-1/2 .10c					
12x1x1-1/2 .12c	9x1x1-1/2x2	15c			
14x1x1-1/2 .14c	10x1x2x2	20c			
16x1x1-1/2 .16c	16x1x1-1/2x2	20c			
Control Tube Components				3x3/16x20 12c	
Testor A or B cement					
Clear Dope	1 oz. 10c	2 oz. 20c	8 oz. 80c		
Thinner	1 oz. 10c	2 oz. 20c	8 oz. 80c		
Colored Dope	1 oz. 10c	2 oz. 20c	8 oz. 80c		
Red, Orange, Yellow, Green, Lt. Blue, Metallic Red, Metallic Blue, Black, White, Silver, Olive Drab					
Music wire	3 ft. .020 & .030, 3c; .035 & .040, 4c; .045 & .050, 5c; .055 & .060, 6c; .065 & .070, 7c; .075 & .080, 8c; .085 & .090, 9c; .095 & .100, 10c				
Silksman, White	100 sq. sheet; 50c; 1/2 sq. 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/512, 1/1024, 1/2048, 1/4096, 1/8192, 1/16384, 1/32768, 1/65536, 1/131072, 1/262144, 1/524288, 1/1048576, 1/2097152, 1/4194304, 1/8388608, 1/16777216, 1/33554432, 1/67108864, 1/134217728, 1/268435456, 1/536870912, 1/1073741824, 1/2147483648, 1/4294967296, 1/8589934592, 1/17179869184, 1/34359738368, 1/68719476736, 1/137438953472, 1/274877906944, 1/549755813888, 1/1099511627776, 1/2199023255552, 1/4398046511104, 1/8796093022208, 1/17592186044416, 1/35184372088832, 1/70368744177664, 1/140737488355328, 1/281474976710656, 1/562949953421312, 1/1125899906842624, 1/2251799813685248, 1/4503599627370496, 1/9007199254740992, 1/18014398509481984, 1/36028797018963968, 1/72057594037927936, 1/144115188075855872, 1/288230376151711744, 1/576460752303423488, 1/1152921504606846976, 1/2305843009213693952, 1/4611686018427387904, 1/9223372036854775808, 1/18446744073709551616, 1/36893488147419103232, 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winner and received a production contract for 400 airplanes at a cost of \$5 million.

The Fletcher airplane was the only original design in the contest and most observers feel it would have been a certain winner had it not suffered its great tragedy. But though it is now only in aircraft history, it presents an original and effective contribution to aircraft design and a tribute to the designing talent of the Fletcher family of Pasadena, Calif.

Bob Cat

(Continued from page 25)

Cement it securely in place and when dry, bend the two top rails together and fasten them to the sides of piece P-1. Hold with a clamp until dry.

Now round off the front of the wing mount and add the two 1/8" by 1/4" up-rights and the cross brace. Note that the planking forward of the firewall has the grain running vertically, while the rest of the mount is planked with the grain parallel to the thrust line.

The entire fuselage assembly is covered with tissue or silkspan for added strength. Before color doping, apply three coats of clear dope, sanding between each coat. If you are using glow-plug, apply fuel proofer generously inside the engine compartment.

WING CONSTRUCTION: The wing ribs are cut from medium hard balsa and sanded to a smooth contour. Select a good grade of hard balsa for the spars and leading edge. Pin the spars down and after placing the ribs in position add the leading edge and the trailing edge. Leave out the ribs that are located at the dihedral joints. They are added after the 1/6" plywood gussets have been cemented in place. These ribs will have to be cut to allow space for the gussets.

When the swing frame is dry, sand the ribs very carefully where they meet the spars, leading, and trailing edges. This will produce a better covering job and hold the true shape of the airfoil. Apply four or five coats of clear dope and be sure to correct any warps that may have occurred.

STABILIZER: The stabilizer is built in the same manner as the wing. Pin down the spar, line up the ribs and glue the leading and trailing edges in place, but be sure to have a piece of 1/8" sheet balsa between the ribs that support the rudder. Add gussets to the tip ribs to prevent warping. Sand the stabilizer well before covering. The stabilizer is also doped before the rudder and tip skids are added. The paper is cut in between the center ribs that support the rudder.

RUDDER: The rudder is made of 1/8" sheet balsa. Trace the full size from the drawing and cut to shape. After gluing the rudder together, place two pieces 1/8" x 3/16" in the center of the rudder and sand to an airfoil shape. Sand all joints well before covering. The rudder is covered with silkspan and doped four times. It is now ready to be set in the stabilizer between the two center ribs. Check to see that it has true alignment.

FLYING: The Bobcat is now ready to be checked-out for flying. First locate the longitudinal balance point which should be 2/3 of the chord back from the leading edge. Add weight or shift accessories until your model balances correctly. If ignition is used, locate the batteries on the back of the firewall, and the coil close to it. This weight must be kept high. If glow-plug is used, just check for the balance point. The next step is to glide the model from about shoulder height. If there are any signs of stall take out incidence in the wing or add incidence to the stabilizer.

For the power-on tests, the author believes that a 5 to 7 sec. try at low speed flight should be made. This will give you a chance to check for the correct thrust alignment.

Each time you feel that you have corrected a spiral or looping tendency, add more power to see how the model reacts. The original Bobcat was worked out to a steep spiral climb to the right and it would glide to the left. Transition from power-on to glide is a smooth roll with no loss of altitude.

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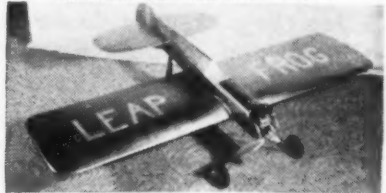
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Yankee IV

(Continued from page 17)

glide. This can be seen before the gear goes up on take-off. The model immediately becomes more buoyant when the gear pops up. The fuse type of release is used because it is light, foolproof and simple to operate. Frankly, the idea for a fuse release came from the well known pop-up tail dethermalizer.

The necessity for an absolutely reliable retracting landing gear is obvious. If the gear folds up too soon the model can be ruined by prop blades clipping the ground; on the other hand, a landing gear that refuses to retract fully defeats the purpose of a retracting landing gear. This landing gear has proved itself in dozens of successful take-offs in both wind and calm, and it is a feature to be found on all the author's cabin designs.

The twin rudders, while not unusual, are very effective on this particular model. Their end-plate effect increases the efficiency of the horizontal stabilizer. Their use was dictated by the single wheel landing gear to provide 3 point contact for take-off. It is interesting to note that Ellila's winning Wakefield model uses small end plates to eliminate tip vortices on the stabilizer. Yankee IV uses the same basic idea but the central fin is eliminated. This makes mounting the dethermalizer a much simpler task.

The airfoil used in the wing is the NACA 4612 first championed by Bill Winter for model use. The author has used many airfoils on Wakefield designs including the RAF 32, Eiffel 400, and Clark Y, but has never used one that has the "hanging" ability of the NACA 4612. The model seems to hang in the wind without stalling or sinking and the airfoil is primarily responsible for this. In the climb, the airfoil seems to act like a very thin section giving a fast "whooshing" climb. Yet in the glide it acts like a heavily undercambered section giving a beautiful glide.

Generally Yankee IV is a simple model with no unnecessary structure or frills. It is easy to field-repair, as was proved at a recent contest when the motor broke. A few crosspieces and patches were all that were needed to get it back into the air within a half hour. Yankee IV was designed to climb fast to get up out of ground turbulence, and on 700 turns it will climb nearly O. O. S.

Contest records to date include a ribbon and team place won at the Washington State Wakefield Semi-finals, although it was subsequently impossible to get to the Finals in Sacramento, Calif.; a trophy won for first place in Open Rubber at the Regional Plymouth Meet (in this particular contest Yankee IV scored the highest time of all rubber models in the meet, including stick models); and a trophy won at the annual Western Washington Model Contest sponsored by the West Seattle Model Club (first place in open rubber again).

The plans of the model are shown 1/4 scale, but the full size parts and ordinates greatly simplify the job of enlarging.

FUSELAGE: The entire fuselage is constructed of 1/8" sq. balsa. A word of caution—select your balsa carefully! Use rock hard 1/8" strips for the longerons and medium for the upright and crossbraces. Fill the nose section with 1/8" flat medium and the same for the rear rubber mount area. While building the side frames, glue the 1/8" sheet bulges to the lower longerons. This helps to lock the fuselage and prevents warping out of line. The side frames are joined with 1/8" square crossbraces 2-1/4" wide from station 7 to 11, making a total of 2-1/2". The fuselage is 1-3/4" wide at station 1, 7/8" wide at station 19. Fit the other crossbraces to continue the normal fuselage curve.

The landing gear bulge is planked with 1/32" sheet, and be sure to build a small well inside the wheel opening to prevent dirt from getting inside of the fuselage. The landing gear strut is formed from 1/16" wire; slip the 1/16" I.D. tubing over this wire before making the bends.

PROPELLER: The prop is carved from a medium block 17-1/4" x 1-3/4" x 2". This may be cut down from a JASCO 18" prop block. The hub should be made of hardwood for durability and drilled on a drill press for accuracy. The hinges are either JASCO or AIRCO, and should be 3/8" wide. Whatever style hinges are used be sure they work freely, with no binding or tightness. If a hinge is tight after the prop is completed, a little rubbing compound applied to the hinge while working the prop blade back and forth will loosen it up. Cover the prop with a light grade of silkspan. Using the silkspan wet helps to get it around some of the compound curves in the prop blades. The prop should be given at least six coats of thin dope, lightly sanding between all coats. A final coat of glider polish will give it a smooth waxy surface.

WING: The wing should be built in one piece for accuracy. Pin down the main spar of 1/16" x 1/4" hard balsa, the leading edge of 1/8" square medium and the 1/8" x 1/2" trailing edge of medium balsa. The leading edge will have to be elevated about 1/4" off the board and the trailing edge shimmed up 1/32" so that the ribs slide in place and match without forcing. The ribs should be trimmed individually and fitted to the spars. Work slowly and check carefully. A wing that is lumpy due to poor workmanship is also prone to warps and is inefficient.

The sheet planking is best fitted by pinning and gluing it to the 1/8" x 1/16" upper spar first; it is then rolled down over the ribs and pinned and glued to the leading edge. Be sure to put a line of glue along where each rib touches the planking, so that when the wing is water sprayed, the planking will lay flat. Put in the dihedral before planking the wing, however. Dihedral braces are 1/16" sheet rock hard balsa; refer to plan for their location on the main spar.

STABILIZER: The stabilizer needs little explanation, but be sure the end ribs are perfectly square so that the rudders will line up properly. Use medium balsa for the entire stabilizer and keep the structure light. The hinge should be glued and bound to the leading edge before the stabilizer is covered. Plank with 1/32" sheet same as the wing.

RUDDERS: The twin rudders are conventional in construction. Use hard balsa for the outline and soft for the crosspieces. Allow them to dry on the board overnight so that they will be perfectly flat. After they are sanded, rub in two coats of glue around all outline joints. Only the right rudder tab is hinged with soft iron wire for adjustment.

COVERING: The whole model should be covered with Jap tissue, all red or red and yellow combined. Jap tissue is recommended because it is very light and tough. The fuselage must be double covered, alternating the direction of the grain of the tissue. Probably the easiest way to double cover is to apply the first layer with the grain running up and down. Watershrink and apply one coat of clear dope. When this is dry, sand very lightly with the finest sandpaper. Then apply the second layer of tissue with the grain running lengthwise. Watershrink and then dope with three thin coats, plasticizing the last coat.

The rudders should be pinned down while they are being doped, to prevent warping. All the other surfaces are single covered and three or four thin coats of dope will give a smooth job.

WING CABIN: The wing cabin outlines are glued to the two outside ribs of the center section. Do this with the wing strapped to the fuselage so that the cabin will match with the fuselage sides. Some trimming will probably be necessary. When the cabin sides fit accurately, add the 1/8" square crossbraces and 1/16" x 1/8" braces at each end of the cabin. Then plank with 1/32" sheet.

DETHERMALIZER AND LANDING GEAR RETRACTION: The dethermalizer on this model is actuated by stretching several rubber bands between the wire hook in the top of the stabilizer and the 1/16" dowel running through the fuselage

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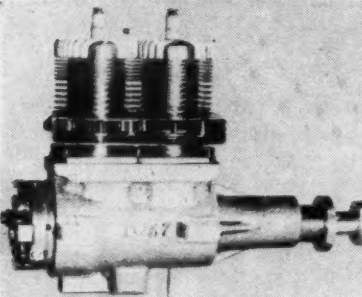
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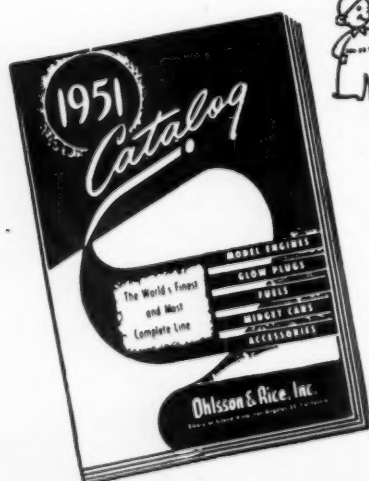
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at station 18. This will pull the stabilizer up. Limit the action to about 30° by using a length of thread sewn and glued to the trailing edge of the stabilizer and the rear of the fuselage.

The landing gear is held in the up position by two rubber bands stretched between the landing gear strut inside of the fuselage and the small hook between stations 1 and 2, also inside the fuselage. To lock the landing gear down, use a rubber band between the hook on the landing gear strut and the other hook on the outside of the fuselage. To release the landing gear, a very short fuse is inserted in the rubber band that locks the gear down. It is quite a kick to see the landing gear pop up after the model is airborne and climbing steadily.

ASSEMBLING: The dethermalizer hinge wire is spread open and the spurs are pushed into the diagonal braces of the fuselage between stations 18 and 19. Allow about 1/16" clearance between the rear of station 19 and the leading edge of the stabilizer. Check for alignment and glue the hinge wire solidly to the fuselage. The stabilizer is keyed by 1/16" dowels glued under each side of the trailing edge next to the fuselage.

The rudders are glued solidly to each end of the stabilizer. Line up the bottom edge of the 1/8" x 3/8" crossbrace in the rudders with the bottom of the end rib, and overall alignment is assured. The wing is held to the fuselage by rubber bands wrapped around the entire fuselage and over the wing. This looks a little crude but it allows for any changes in adjustment, and the wing is free to slide in event of a crackup or collision.

POWER: A variety of rubber motors may be used in this model. The author has had best results with English Dunlop both in the 3/16" and 1/4" sizes. Dunlop is thicker than our own T-56 and gives more power on less strands. However, T-56 is very satisfactory when motors are changed between each flight. All motors are 33" long and unbraided. The following number of strands is recommended: Dunlop 3/16" flat, 22 strands; Dunlop 1/4" flat, 18 strands; T-56 3/16" flat, 28 strands; T-56 1/4" flat, 22 strands. No matter what rubber is used, lubricate it well and wash the motors after each day's flying in lukewarm water to remove grit and lubricant. Store your rubber in a vacuum jar in a dark cool place and sprinkle liberally with talcum powder. A rubber motor that is treated right will last several years without becoming brittle or "dead."

TEST FLYING: We now come to the most critical phase of a new model's life. Careful testing will definitely pay off. Wait until a calm day or evening comes along to test your model. Little can be learned about a new model on a windy day. If

possible, fly your model in a large open field that has tall grass. Check the C. G. to see it is at about 50% of the wing chord. Shift the wing until it reaches this position. Next try a hand glide, gently pushing the model. A few hand glides will familiarize you with the approximate gliding speed of this design. The glide should be slightly fast and nose down with the model skidding in on the retracted wheel. If a stall is apparent, shim up the trailing edge of the wing 1/16" at a time until the stall disappears. If the model dives, shim up the trailing edge of the stabilizer 1/16" at a time. Contrary to generally accepted rules, the author has found that increasing the packing under the trailing edge of the stabilizer is much more effective and positive than shimming up the leading edge of the wing. At the same time that you are checking the glide, add right rudder with the tab until it is offset about a 1/4". This will give a wide sweeping circle to the right. The power flight is easy once the ship is gliding correctly. Downthrust is built in, and a little left thrust should be added so that the model climbs in a very wide right turn. Any stalling or diving that shows up in the glide may be corrected by removing or adding incidence. The same applies to the power run, only in this case vary the downthrust. A slight hanging in the climb may be removed by adding right rudder. Remember that a little too much downthrust will never hurt the model, but too little will!

The author strongly suggests using the dethermalizer each time you make a flight. A test of this model in the late afternoon on 300 winds led to a 3 mi. chase!

Fred Partridge in Sydney, Australia has built a model of this design and reports he has been averaging 2-1/2 to 3-1/2 min. in calm evening air on 600 winds, using Dunlop rubber with the model rigged slightly nose-heavy for windy weather. Further "proof of the design" is seen in the fact that a Class E version of the Yankee IV holds the AMA record as this is written, with a time of 23 min. 16 sec.

Best of flying and keep your dethermalizer lit. The author would be pleased to hear your comments on this model. Send your photos to "Airways Column."

Try Flying Wings!

(Continued from page 15)

were the first to be totally without bugs. The Gull, incidentally, placed in the 1949 Mirror Model Flying Fair.

At this point let us stop and see what was wrong with the earlier models, planes 3, 3a and 4. According to theory, lateral stability will be good when a line through

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the C.G. and C.L.A. (center of lateral area) is approximately parallel to the thrust line. It will be noted that the C.G. was quite low on these planes as the motor was mounted low. The C.L.A. was rather high with respect to the C.G., the dihedral plus the tip rudders contributing to the high C.L.A. On the later versions (planes 5 and 6), the C.L.A. was lowered with respect to the C.G. by removing the tip rudders and placing this area below the C.G. instead of above it. Thus with the C.L.A. lowered sufficiently, lateral stability was achieved. It will be found, as in this case, that much better results will be obtained by paying heed to the height of the C.L.A. There is another factor that probably contributed toward the success of the later planes, i.e., the improved angle of the rolling axis. The more the rolling axis points down hill, the greater the tendency for a ship to spiral dive, as was the case on the earlier models. The rolling axis of a plane may be approximated by making a cardboard silhouette of the model in the usual fashion, and finding the C.L.A. by locating the C.G. of the cardboard profile. Now cut the cardboard vertically through this point. Then determine the C.L.A. of the front half and the C.L.A. of the rear half and mark these two points. Put the two halves back together and draw a straight line through these two points. This is the rolling axis. On the later versions, the C.L.A. of the rear half was moved downward by removal of the tip rudders and placing this area below the wing. The front C.L.A. meanwhile remained virtually unchanged. Thus the angle of the rolling axis was also improved besides lowering the C.L.A., as explained previously.

There are model builders (the writer was formerly one of them) who have their doubts about the C.L.A.-C.G. relationship being important. The results shown by these flying wings lend a lot of weight towards proving the importance of this concept.

It is interesting to note that all of the models possessed complete stability when gliding. Plane 3A appeared to have complete stability both under power and in the glide, only because it flew so slowly under power that it was actually doing little more than power-gliding. The faster flying 4 revealed the bugs. Plane 3 was so far from being stable that even considering the slow speeds at which it flew under power, it showed lack of lateral stability.

At this point, a total of six planes based on the design of the Gull and powered by the .045 Spitfire or .049 Cub were built. One of these ships placed in two of the three contests entered. The planes ranged in size from 400 down to 200 sq. in., the object being to determine the optimum wing area for this size motor. The 200 sq. in. model proved to be overpowered and sensitive to side thrust adjustments, while the 400 sq. incher did not exactly possess the hottest climb ever seen. It seemed that a flying wing whose wing area was around double the amount that would be used on a conventional craft was just about right to give the equivalent climb and glide. At first this may seem large, but let us compare a 150 sq. in. pylon job which is fairly typical for this size motor, to a 300 sq. in. flying wing. The conventional job with a 150 sq. in. wing will have a stabilizer area of up to 50% of the wing area, or 75 sq. in. This makes a total of 225 sq. in. of projected area for the conventional job. Add to this the area and drag caused by the fuselage, pylon and the rudder, and the fact that a flying wing is a much cleaner design, and the remaining 75 sq. in. may be accounted for. Thus the drag of a 150 sq. in. conventional job is approximately equal to that of a 300 sq. in. flying wing.

As the size of the planes was reduced for a given power plant, it became necessary to use more downthrust. To eliminate some of this downthrust, the thrust line was raised, by building up a pylon to mount the motor on or by using a cathedral center section (inverted Gull wing) as was done on planes 12 and 13. It is interesting to note that a swept-wing tractor design will appear to the eye to have more downthrust than it actually has. Downthrust is usually

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measured with respect to a line parallel to the stabilizer chord line, which on a craft of this type is the wing tips. On a flying wing, however, the eye tends to measure the thrust line with respect to the wing center section rather than the wingtips, which puts the apparent downthrust in error by the amount of washout in the wing.

At this time, plane No. 13 (see sketch), a small rugged Infant powered sportster, was built. It had 110 sq. in. of wing, weighed 2.2 oz. and had twin rudders hung below and aft of the trailing edge at the lowest point of the wing. The craft was carted off to the field for testing. A few flights revealed that there was too much rudder area. Out came the razor blade and before each flight a little rudder was hacked off. A large portion of the rudders had disappeared with no appreciable effect, and since darkness was approaching, the process was speeded up. One of the rudders was completely removed—still no change. Then both rudders were removed, and with fingers crossed, the plane was launched. Surprisingly the plane climbed beautifully, without the faintest sign of a Dutch roll. The motor cut and the plane started to glide. Here something even more surprising was observed—the plane was gliding with a barely perceptible Dutch roll. Usually when a plane does not have enough rudder area, the craft will first develop an easily detectable roll under power, but glide smoothly. If enough additional rudder area is removed, the plane then will also roll in the glide. (If the rudder or rudder effect is too small for the amount of dihedral, roll due to the dihedral is accompanied by yawing in the opposite direction, which results in an undamped yawing and rolling motion described as a "Dutch roll" because of its similarity to the typical skating motion. If the rudder effect is too great for the amount of dihedral used, the rudder holds up the tail of the plane when it goes into a turn; this accentuates the turn and the airplane will go into a spiral dive. For the free flight model, it is therefore best to

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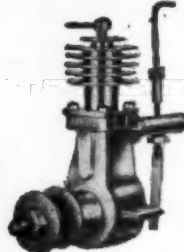
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have a ship with a minimum of rudder area.)

A similar .045 Spitfire-powered plane was tried with its rudder removed, and revealed Dutch roll in both powered flight and glide. (The Infant-powered plane needed less rudder effect than did the similar .045 Spitfire design because of the higher concentration of weight in the center of the plane, thus giving relatively a lower moment of inertia to the Infant job. The motor constitutes about 50% the total weight of the Infant-powered plane, and but 25% the total weight of the Spitfire-powered craft.) A little rudder area was then added to the Spitfire job and the same effect as appeared in the Infant-powered craft was again noted—the ship Dutch rolled in the glide and not under power.

With the development of this interesting fact, further experimenting was undertaken. Plane No. 12 powered by an .049 Cub was tried with many rudder arrangements. The rudder was kept out of the slipstream to minimize its effect under power, as the above mentioned development would probably prove bothersome on a high powered flying wing. Therefore, a variety of double rudder arrangements were tried. Vertical wing tip rudders hung above or below the wing, toed in, parallel,

or toed out, substantiated the earlier results, that is—vertical wing tip rudders were detrimental to lateral stability under power. Twin rudders similar to those used on planes 5 and 13 were also tried and worked fairly well, but these necessitated a long unwieldy landing gear. Drooping wing tip rudders were also tried but removed too much of the dihedral effect for the plane to fly satisfactorily.

Upraised tip rudders were again tried. This time instead of merely adding the rudders to the ship, the amount of dihedral was first decreased to make up for the added dihedral effect of the upraised tip rudders. Three sets of detachable rudders were made from sheet balsa. Set number one had a simple cambered airfoil with the concave or cupped side on the top (upside down airfoil). Set number two had a flat airfoil. Set number three had a cambered airfoil with the concave side on the bottom (right side up airfoil). The plane glided and flew well at low power with all three rudder types; with high power a definite difference was noted. Type one resulted in a model that looped despite a high thrust line and considerable downthrust. This no doubt was due to the fact that the faster a lifting surface travels the greater the lift, which in this case "lifted" the wing tips

downward, and the nose of the plane up. When a tight turning climb was attempted, the low wing would stay down and oblique loops resulted rather than a corkscrew climb; right or left hand flight making no difference. Further tightening of the turn would result in a spiral dive. Set number two was an improvement but not entirely satisfactory. Set number three really did the trick. The looping tendency disappeared and when a tight turning climb was tried, the low wing would come up and a beautiful corkscrew climb resulted. The plane could also be flown with a wide sweeping climb, if desired. In the case of the third rudder set, the increased lift generated by the higher speeds resulted in an upward lift on the wing tips thus tending to balance the increased lift by the airfoil sections in the forward part of the plane. Considering this type of wing tip arrangement in its other function, that of acting as a rudder, it becomes a case of toed-in tip rudders, which is actually not a new concept. Toed-in rudders were first introduced by Dr. Alexander Lippisch, noted designer of full size flying wings, and have found general adaption on other type of craft as well as flying wings. To explain the effect of toed-in tip rudders briefly, let us first take the case of a plane with parallel tip rudders having a symmetrical airfoil. At low angles of yaw, a few degrees change in yaw produces very little change in drag—thus their effectiveness is small. (Due to tip losses, the low aspect ratio of tip rudders, and in the case of models the losses due to scale effect, the lift vector rapidly loses and the drag vector becomes most significant.) At higher angles of yaw, a few degrees change in yaw produces a proportionately larger change in drag than at the lower angles. Thus if the rudders have sufficient effect at the high angles of yaw, they may not have enough effect at the low angles. Making them larger to render them more effective at the low angles may result in them being too effective at the higher angles of yaw. The way out of this is not to operate the rudders at low angles of yaw. This is done by toeing them in, so that when the plane yaws a small amount, the foremost rudder is actually at a larger angle of yaw and therefore effective. The net result is that the craft will swing into the relative wind. This same effect of toed-in rudders may be achieved aerodynamically rather than geometrically by using parallel rudders with cambered airfoil sections, placed so that the concave side is outboard (lift is generated inboard). This was the case of rudder type No. 3.

By this time two thoughts may occur that seem contradictory. One is that a few of the early Northrop flying wings used drooping tips, while this model uses raised tips. In both cases the tip acts as a rudder. However, the upraised tip adds to dihedral effect, whereas the drooping tip subtracts. This is simply the old story of models requiring larger amounts of dihedral than the big craft. The other thought that may have occurred is that upraised tips were already tried in planes No. 3A and 4, which were not entirely satisfactory. That is correct, but two basic differences tell the story. The first is that the motor of plane No. 12 was raised several inches, thus raising the C.G. Secondly, planes No. 3A and 4 had the normal amount of dihedral, to which a raised wing tip was added. This produced a high C.L.A. Plane No. 12 had a smaller dihedral angle (relying largely on the raised tip to give sufficient dihedral effect) and, therefore, a lower C.L.A. Both these facts add up to a more suitable placement of the C.L.A. with respect to the C.G. This was not the case in planes No. 3A and 4.

The photo and sketch show plane No. 12, with its cambered wing tips permanently attached. From this stage, four more planes based on this design were constructed, no two being identical with respect to airfoil or airfoil combinations. The most successful of the airfoil sections tried will be discussed later.

To demonstrate the fact that flying wings are more than just a novelty, the final version, plane No. 17, proved to be a fine performer and a tremendous contest ship.

Air Ways

(Continued from page 29)

Cub .049 engine swinging a Topflite 6" x 4" propeller. Overall weight was 6 oz. and wing area 144 sq. in. The landing gear retracts and the fuse-type dethermalizer is standard equipment.

Picture No. 4 proves that modelers do not necessarily always copy the hottest contest designs. Here we see Ivan Gause (Stenstromsgatan 1A, Gothenburg, Sweden) holding his model of the ROGUE built from plans published in M.A.N. The airplane was built the day before he left for a seaside vacation and he found it to be ideal for such flying. The model even landed several times in the water with no damage or warpage. Power was an Anderson Baby Spitfire.

Representative of the "Flying Barndoors" this month is Picture No. 5, showing an original design by Lloyd E. Carter (9632 San Vicente Ave., South Gate, Cal.). This big stunter has a span of 60" and a chord of 10-1/2". It is fitted with an Orwick 64 engine operating on spark ignition, and has proven to be an extremely able design. Mr. Carter designed this ship for really rugged action; the wing is built up with two pine wingspans of 1/4" x 3/4" and two more spars 1/4" x 1/2". He says that the ship will stand the most violent stunting at high speed without tearing off the wings.

Walter Skotchdopole (693 Belmont Ave., Brooklyn, N.Y.) is an enthusiastic flyer of rubber powered helicopters. We see him in Photo No. 6 holding one designed by Harry Robbers. The model has made many flights, most of which were over 2 min. duration.

A very attractive scale model of the Skimmer XC-1 amphibian is seen in Picture No. 7. This model was built by Warren D. Shipp (812 Crown St., Brooklyn 13, N.Y.), who incidentally took the photographs for our plane of the month story on this airplane in the October 1950 issue of M.A.N. After taking dozens of photographs of the original amphibian, Warren became so intrigued that he went to work on the scale model shown. In his particular version of the model, the Baby Spitfire is mounted in an inverted position with the cylinder hanging down inside the pylon. Some trouble was experienced with the fuel feed and cooling in this version, and Warren then turned the motor right side up with the cylinder sticking upwards through the top of the nacelle. The engine ran much better in this position but was found to have insufficient power, and experiments are now under way with other motors and different propellers to find the proper combination. Regardless of the fact that the model was reluctant to make like a bird, it showed excellent flotation qualities, and Warren and several friends spent a whole afternoon waiting for the plane to drift across a small lake, after it had gotten away from them, and no boats were available.

From New Zealand comes Photo No. 8 showing George Paashe (112 Dixon Street, Masterton, New Zealand) holding his sailplane which he calls the Jinx. This glider has an overall length of 45", a 6' span and weighs 16-3/4" oz. ready to fly.

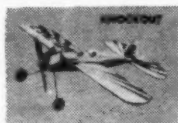
A famous pre-war design comes to light again in Picture No. 9 where we see the Flying Flea as built by L. W. Christensen (518 E. 134 St., Hawthorne, Cal.) from plans in M.A.N. The little plane sports quite a snappy decoration scheme which was copied from decorations found on some of the full size planes. Mr. Christensen had a bit of tough luck on the first flight as the controls were arranged improperly. He is rectifying this difficulty, however, and feels that the model should make a good stunt job, since on its first take-off, it made a very snappy loop, but didn't quite make it all the way around.

Two models built in Tokyo by Lt. Ned W. Hollingsworth (HQ 610 Ord. BN. APO 712, c/o P.M., San Francisco, Cal.) are seen in Photo No. 10. The biplane is of his own design and is powered with an Anderson Spitfire. The Spitfire cylinder is the uppermost one, the other four being built-up

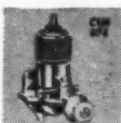
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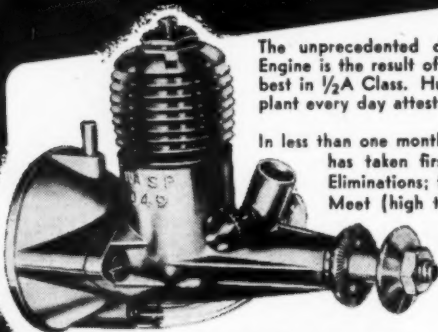
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dummies. The model has been found very adaptable to stunting, and flies at a speed over 75 m.p.h. It can carry a 20 min. fuel supply and normally flies on 80' lines. The little Goodyear racer is powered with an Ohlsson 23" and is also a very satisfactory performer.

Picture No. 11 shows a rubber powered Supermarine S.6.B., constructed by Mr. P. O'Keefe (9 Albion Place, Maidstone, Kent, England). It was built to 1/2" scale and the wingspan is therefore 16". Weight is approximately 2 oz., and conventional formers and stringers were used in the fuselage and floats. All possible external detail was included. The model is fitted with wire bracing, control surface balances, engine air inlets and oil cooler lines, and a scale model pilot.

Another scale project, this time an ambitious non-flying job, appears in Photograph No. 12. Here we see a built-up scale DC-3 transport plane constructed by Eugene Adams (25 N. Grant Wood, Toledo 13, Ohio). The model has a 6' wingspan and is planked with 1/32" sheet balsa inside and out. It has retractable landing gear, movable control surfaces, and is fitted with seats, hat shelf, restroom window curtains, etc. About four months were needed for this beautiful job.

Design Forum

(Continued from page 13)

zero lift angle varies and depends upon the camber). Then it will operate to all intents and purposes the same as the flat stabilizer, with one exception. It will give greater lift than the flat stabilizer at positive angles of attack. The corrective moments react qualitatively the same but are greater with the cambered stabilizer. Consequently, less area is required with the cambered stabilizer than with the flat one, actually about 20 to 25% less. It is obvious, therefore, that where stabilizer area is restricted by contest rules or structural considerations, cambered stabilizers may be used with good effect because they give more correction per square inch of area.

Fig. 3 shows a customary arrangement with a cambered stabilizer. In this case, the wing is set at 2 1/2° angle of incidence and the stabilizer is set at 0°. The actual lifting angle of the wing is 4 1/2° and that of the stabilizer 2°. In such a set-up, the stabilizer lifts about 42% as much per square inch of area as the wing, and because of this lifting effect, the center of gravity usually is located to the rearward of the wing-center and is often as far back as the trailing edge, as shown. This indicates that the weight of the plane is lifted partly by the stabilizer and partly by the wing. The difference in angle between the two surfaces provides the corrective effect longitudinally as in Figs. 1 and 2. Although this effect is less with the set-up in Fig. 3 than with that in Fig. 2, because there is less difference in angle between the surfaces, this small difference of 2 1/2° between the lifting angles is sufficient for good operation, especially in very fast airplanes. Incidentally, the faster the airplane the less is the difference in angle between the surfaces that can be tolerated, because the nosing up tendency with any setting is increased with speed; with greater speed, the difference in angle must be less. This is one of the reasons why the wings and stabilizers of control line models are set practically neutral. No difference in angle is needed for stability which is taken care of by control operation.

Mr. Francis K. Heeb of 313 1/2 Western Avenue, Connorsville, Indiana, brings up several interesting points concerning stabilizers and longitudinal stability. He asks, "I wonder if you can give me some sort of relation between percentage thickness of stabilizer section and percentage of wing area."

Yes we could, but it would have no significance because functionally there is no direct significance between these two factors. The thickness of the stabilizer section has a decided effect upon longitudinal stability and upon the size of the required stabilizer area. We may say that because



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of this, indirectly it has an effect upon the wing area, but this is like going to San Francisco from New York by way of the Suez Canal and Japan, instead of going straight across the country. The important thing is the area of the stabilizer compared to wing area, giving consideration to the fact that the stabilizer area required may be modified by using different stabilizer cambers, as explained in previous paragraphs.

There is a very important relationship, however, between the camber of the stabilizer and the camber of the wing and one which is often abused by modelers. To understand the effect of using different cambers on these two surfaces consider Fig. 4. A comparatively thick section is used on the wing. The lift of this section at various angles of attack is represented by the approximately accurate curve, W. Because the camber is very high, this section starts to lift at a large negative angle (-4°) and the lift increases as indicated by the curve, with maximum lift occurring at about 14° to 16° . You will note that as the angle of attack increases, the lift gradually drops away so that the top of the curve is a smooth rounded arc. In other words, there is a gradual decrease in lift relative to angle of attack.

Now look at the stabilizer section curve. This is a comparatively flat-cambered section and the lift increases rather sharply and does not drop away as quickly as the wing section until it reaches a stalling point, where there is a sudden break in the lift. The angles of attack are indicated in the lower column of angular readings. This low camber section starts to lift at only -2° . The important thing is that the slope of the stabilizer curve is not as steep, and the lift does not decrease as rapidly as the wing section with an increase in the angle. This means that the lift on the wing drops away faster than the lift on the stabilizer as the stalling angle is approached. As a result, the lift on the stabilizer becomes comparatively greater so that corrective moments are increased considerably with increase in stalling angles.

With the cambered stabilizer set at 0° and the wing at $2\frac{1}{2}^\circ$ positive, the lift for the wing will be shown by curve W, Fig. 4. The lift for the stabilizer will be indicated by curve S_1 , with its angular readings in the second row as indicated, where 0° is directly under $2\frac{1}{2}^\circ$. The lift on this stabilizer surface will be indicated by point S because on this low-cambered surface the lift is zero at -2° .

Now you will see that as the angle of attack increases, the steepness of the wing curve decreases more compared to the stabilizer curve, meaning that the lift on the wing drops away faster compared to the lift of the stabilizer. You will note that the lift of the stabilizer, at normal flight setting, is approximately $\frac{1}{3}$ of the lift of the wing per square inch. However, suppose that the angle of attack increases 4° on both surfaces, then the stabilizer will be lifting at point S_1 and the wing at point W_1 . Now we see that the lift per square inch for the stabilizer is more than 66% of the lift of the wing, so the lift of the stabilizer compared to the wing is 100% greater than in normal level flight. In other words, the stabilizer lift increases more rapidly than the wing lift. It is this fact which causes longitudinal correction.

If we have a flat stabilizer instead of a cambered stabilizer, set at 0° , it will be represented by the lift curve S_2 . At 0° it produces no lift. At $+4^\circ$ stabilizer angle of attack, the lift is increased considerably but not as much as in the case of an equivalent cambered stabilizer shown by curve S_1 (set at -2° , or at zero lift). The slope of the flat stabilizer curve also is not as steep as that of the cambered stabilizer, indicating that the lift does not increase as rapidly with an increase in the angle of attack and, therefore, this type of surface is not as effective as a cambered surface. If the cambered stabilizer of the arrangement in Fig. 4 is set at -2° (zero lift) instead of at 0° , the stabilizer lift will be represented by curve S_3 . Then if the angle of attack increases 4° , the lift will be indicated by point B_3 , which is considerably more lift

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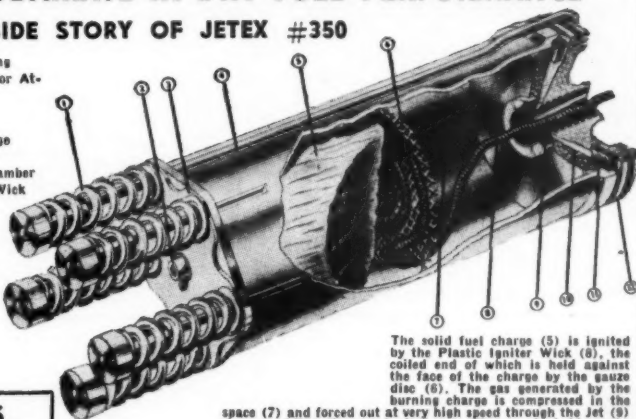
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PENNY

By Harry Hoening

than that generated by a flat stabilizer, point D, under similar conditions.

Now suppose a model is built with a medium camber wing and a stabilizer with higher camber than the wing, the wing being set at 3° and the stabilizer at 0°. The lift curves representing this arrangement are shown in Fig. 5. Points W and S indicate the lift of wing and stabilizer respectively at level flight angles of attack. Remember that the effectiveness of the stabilizer is shown by how much the quantity, $\frac{S}{W}$, increases as angle of attack increases. So, in the arrangement with high camber on the wing and lower camber on the stabilizer (fig. 4) the quantity, $\frac{S}{W}$ is about 1/3 at level flight angles. When the angle of attack is increased 4°, it is about 2/3. The increase, therefore, is 2/3 - 1/3 or 1/3. This in an increase in stabilizer effectiveness of 100%, with 4° increase in angle of attack.

Considering the arrangement in Fig. 5, $\frac{S}{W}$ = 3/4 at level flight angles. At 4° angle of attack $\frac{S}{W}$ is 4/5. The increase in stabilizer effectiveness is, $\frac{4/5 - 3/4}{3/4} = \frac{16/20 - 15/20}{15/20}$. The percentage increase is $\frac{1 \times 100}{15}$ or 6.66%, as compared with 100% in the Fig. 4 arrangement, where the stabilizer has less camber than the wing.

These conditions, discussed, are based upon the stabilizers being set at 0° angle of attack, where the stabilizer, Fig. 4, has 2° of lift and that in Fig. 5, 4° of lift, (both lift at these negative angles of attack). If both these stabilizers are set at equal angles of lift, the stabilizer of Fig. 4 would be set 0° and the stabilizer in Fig. 5 would be set at -2°, (curve S₂). Comparing relative lift values of stabilizer and wing at 4° angle of attack in both cases, we can readily see that stabilizer lift S₂ is a larger percentage of wing lift W₂, in Fig. 4, than stabilizer lift B₂ is of wing lift W₂, in Fig. 5, because the slope of the stabilizer curve in Fig. 4 is steeper than the stabilizer curve in Fig. 5. In Fig. 4, it slopes toward the wing curve, while in Fig. 5 it slopes away from the wing curve.

So with the same lifting effect at level flight angles, the arrangement with higher-cambered stabilizer gives less stabilizing effect. When both these stabilizers are set at angles of zero lift (curve S₂, Fig. 4 and curve S₁, Fig. 5), the result in regard to stability is the same. Conversely, in settings of equal stability, stabilizers of lower camber than the wing give more lift at level flight angles, and even at climbing angles.

To give increased stability, high-cambered stabilizers must be set at angles less than zero lift, -5° for instance, and then they give a down-load during level flight instead of lift. Even during climb they are less effective.

Though the difference in effect between low and high camber is often slight, in some cases it is quite marked. It pays therefore, to follow the rule of always using a stabilizer with less camber than the wing.

Bill Pringle, Jr. of 208 Domer Avenue, Takoma Park, Maryland wants to know if proper placing of the C.L.A. will reduce line tension in control line flying. The C.L.A. position (center of lateral area of a model) will have little effect on the flight because a control line model seldom skids in a turn. If it does, it will usually bank and turn sharply inward toward the pilot, so line-tension will be completely eliminated. A crash usually results.

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Send your questions and ideas to Design Forum, c/o MODEL AIRPLANE NEWS, 551 Fifth Avenue, New York 17, New York.



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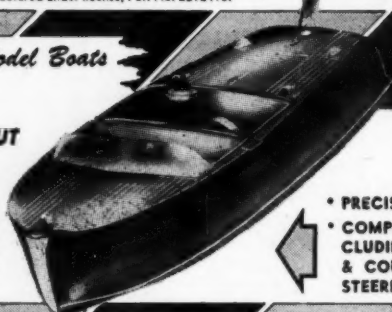
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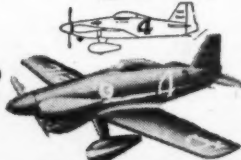
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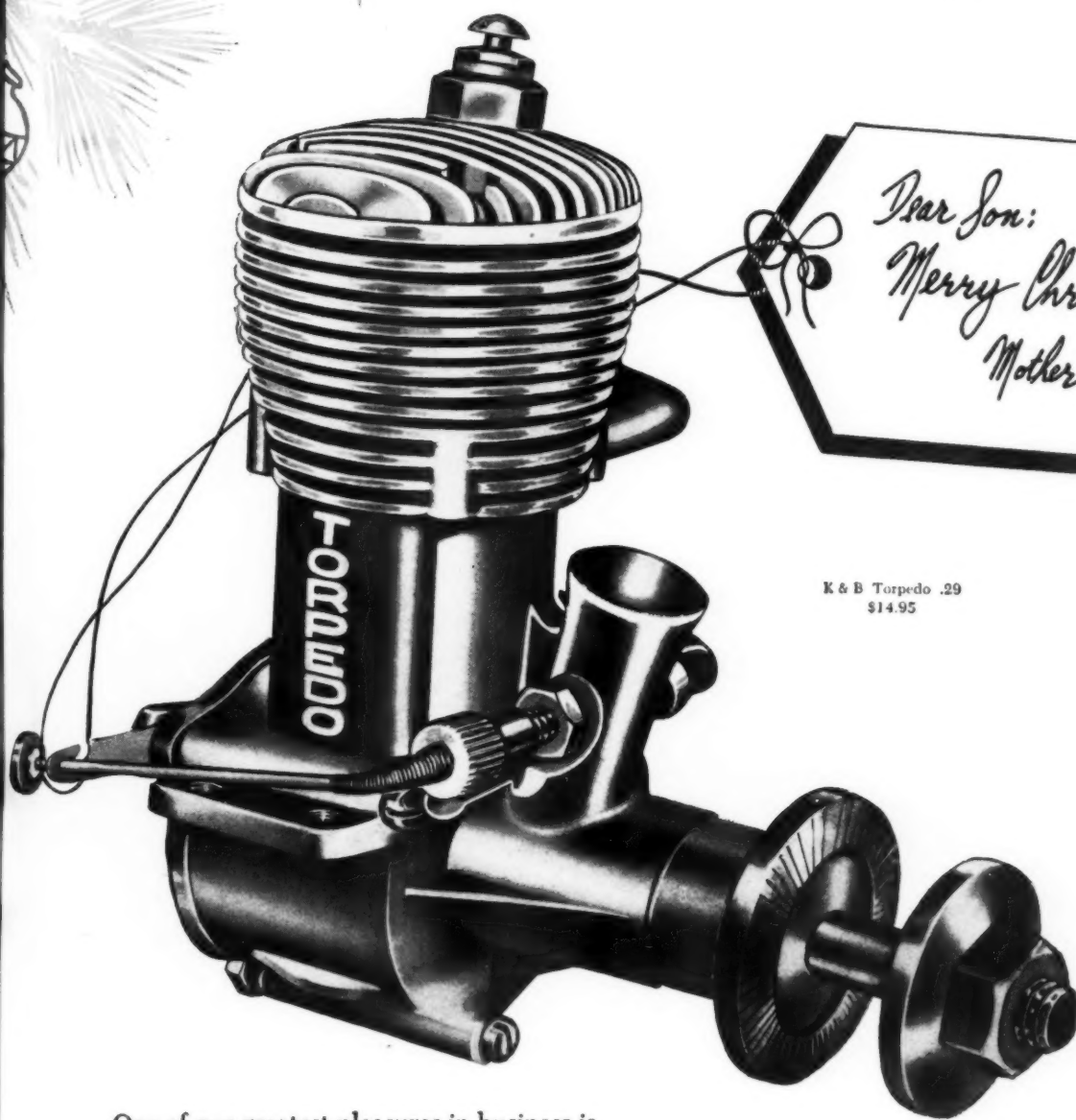
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